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COST AND RETURN IN MILK PRODUCTION OF MEMBERS AND NON-MEMBERS OF DAIRY COOPERATIVE SOCIETIES IN MEERUT DISTRICT OF WESTERN UTTAR PRADESH

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ABSTRACT

The present study was conducted in two block i.e. Mawana and Hastinapur, Meerut district of Western Uttar Pradesh.To know the cost and return in milk production of members and non members of dairy cooperative societies. It was observed that the overall average cost of milk production per liter Rs. 25.18 of members, while non members side was Rs. 22.14 per liter. The category wise cost of milk production was found higher in small farmers i.e. Rs. 28.67 per liter of non member side, Overall average milk production per animal was found 1759.52 liters of members and non members was of 1690.76 liter. The season wise milk production of per animal was found higher in winter season i.e. 756.75 liter in member side and non member side 724.95 liter in overall average. The lowest milk production was found in summer season. The overall gross return from milk was found of Rs. 72725.94 per animal in case of member side, while non member side of Rs. 62337.39. The category wise gross return from milk was found of Rs. 69201.77 of small farmers, Rs. 70378.01 of marginal farmers and Rs. 75913.40 of landless families. The overall average net return from milk per animal in case of member of dairy cooperative societies was found of Rs. 24905.86. The overall average cost benefit ratio was found higher in non member as compared to member of dairy cooperative societies i.e. 1.66 and 1.64 receptively per animal. The net return per animal was found higher in case of members as compare non members.

Key words : Live stock, dairy enterprises, milk cooperative societies, members and non members of respondents

In India dairy is one of the important occupation which is commonly practiced in rural areas. The economy of India is based on crop raising and milk production. The knowledge of cost and returns of milk for encouraging the dairy enterprising. In this regards the dairy cooperative societies are positively influencing the development of villages in India. This study was conducted in Meerut district of Western Uttar Pradesh. It tries to assess the contribution of selected milk cooperative societies in the rural development of the village in terms of upliftment of poor people, increase income level, increase in education level and access to health services. The contribution of the livestock sector to total national gross domestic product (GDP) was 5.9 percent in 2000-01, with the milk group making the highest contribution to the total value of the agriculture and allied sector (Rs.1,44,088 crores). The millions of people are employed in the livestock sector and women constitute about 70 percent of the labour force. Dairying has become an important secondary source of income for millions of rural families and has assumed a most important role in providing employment and income generating opportunity. Indian Dairying is unique in more than one way. It ranks first with its 185.2 million cattle and 97.9 million buffaloes, accounting for about 51 percent of Asia's and about 19 per cent of the world's bovine population (Karmakar:2006). It also ranks first in milk production with a production of 144 million tonnes in 2014. Contributing about 5.3 per cent to India's agricultural GDP, milk is a leading agricultural produce. Livestock sector provides employment to 18 million people and nearly 70 per cent of them are women. Further, dairy sector is the major source of income for an estimated 27.6 million people. Among these, 65 to 70 per cent are small, marginal farmers and land-less labour. The dairy sector supports around 10 million members / farmers through one lakh cooperative societies existing in the country. Apart from employment generated by rearing of animals, the procurement of milk and its processing

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also provides substantial employment. It is well known fact that there are large inter-regional and inter-state variations in milk production as well as per capita availability in India. About two–third of national milk production comes from Utter Pradesh, Punjab, Rajasthan, Madhya Pradesh, Maharashtra, Gujarat, Andhra Pradesh and Haryana. It is also fact that major milk producing regions in country have good resource endowment and infrastructure. The eastern region is lagging behind in term of dairy development. The average per capita availability of milk in India is 355 g per day during 2016-17 was highest in Punjab (1075g per day), followed by Haryana (930 g per day), Rajasthan (785g per day). The average per capita consumption of milk and dairy product is lowest in rural areas than in urban areas, even though milk is providing by rural areas.

RESEARCH METHODOLOGY

The percent study was conducted in Meerut district of Uttar Pradesh. The Meerut district comprises of twelve blocks out of which two blocks i.e. Mawana and Hastinapur were purposively selected for the investigation. The primary data was collected personaly with the help of pre structure interview schedule from the respondents and secondary data was collected from documents. The data was statically analyzed and find out the percentage for per liter cost and returns.

RESULTS AND DISCUSSIONS

The data presented in **Table-1** indicates that the overall average cost of milk production per liter was Rs.25.18 of members. The category wise analysis indicate that the cost of milk production per liter was Rs.28.67 on small farmers, Rs. 25.11 on marginal farmers and Rs.23.87 on landless families. It indicated that cost of milk production was higher in case of small farmers and lower in landless families.

The table further indicate that cost of milk production per litre overall average was Rs. 22.14 in non-members. The category-wise analysis Indicates that the cost of milk production per litre was Rs. 23.57, Rs. 20.41 and Rs. 22.76 in small, marginal and landless category, respectively. It indicates that the cost of milk production was maximum on small farmers and minimum on marginal farmers.

The **Table-2** shows that the overall average milk production per animal in members was 1759.50 litres. It varies according to the season since the milk production was found to be 532.92 litres in rainy season, 756.57 litres in winter season and 470.01litres in summer season. The category wise analysis revealed that the production of milk was1660.14 litres of small farmers, 1741.31litres of marginal farmers and 1815.07 litres of landless families. The milk production was found highest in landless families and lowest on small farmers. It was due to better care and better feeding of animals by the landless families.

The table further shows that per animal overall average production of milk in non-members was 1690.76 litres being 529.22 litres in rainy season 724.95 litres in winter season and 436.60 litres in summer season. The table also shows that category wise milk production was 1635.16 litres on small farmers 1685.39 litres of marginal farmers and 1711.18 litres of landless families. Milk production per animal in landless families was highest.

The **Table-3** shows that the overall gross returns from milk was Rs. 72725.94 per animal. The table further reveals that category wise gross returns from milk was Rs. 69201.77 on small farmers, Rs. 70378.01 on marginal farmers and Rs. 75913.40 in landless families. It shows that per animal gross returns was highest in landless families and lowest on small farmers. It was due to more milk production in landless families in case of members and remunerative prices by the G.D.U.S.S. to members. The table further indicates that overall average gross return per animal in case of non-members was 62337.39. The results further reveals of non-members were found to be Rs. 58752.61, Rs. 61890.78 and Rs. 63715.23 in small, marginal and landless category. It indicates that the returns from milk was highest on landless families and lowest in small farmers.

Table-3 revealed that the overall average net returns from milk per animal in case of members was Rs. 28414.25. The category wise analysis shows that the net returns from milk was Rs. 21609.33 Rs.26660.42, and Rs. 32583.38 of small, marginal and landless category respectively. It shows that net returns from milk was maximum in landless families and minimum on small farmers. The overall average and

Table 1 : The cost of milk production per liters of member and non-members of dairy cooperatives societies.

Category	Milk production per animal per year (liter)	Net maintenance Cost per year (in Rs.)	Per liter cost of milk production (Rs.)
Members			
Small	1660.14	47592.44	28.67
Marginal	1741.31	43717.59	25.11
Landless	1815.07	43330.02	23.87
Overall	1759.50	44311.70	25.18
Non-members			
Small	1635.16	38545.14	23.57
Marginal	1685.39	34406.31	20.41
Landless	1711.18	38950.55	22.76
Overall	1690.76	37431.53	22.14

Table 2 : Season wise production of milk per animal of members and non members of dairy cooperative societies (in litres)

Category	Rainy Season	Winter Season	Summer Season	Total
	Members			
Small	486.32	725.29	448.53	1660.14
	(29.29)	(43.69)	(27.02)	(100)
Marginal	523.16	732.21	485.94	1741.31
	(30.04)	(42.05)	(27.91)	(100)
Landless	559.87	787.37	467.83	1815.07
	(30.85)	(43.38)	(25.77)	(100)
Overall	532.92	756.57	470.01	1759.50
	(30.29)	(43.00)	(26.71)	(100)
	Non-members			
Small	521.36	690.91	422.89	1635.16
	(31.88)	(42.25)	(25.86)	(100)
Marginal	528.85	727.83	428.71	1685.39
	(31.38)	(43.18)	(25.44)	(100)
Landless	531.86	733.65	445.67	1711.18
	(31.08)	(42.87)	(26.040)	(100)
Overall	529.22	724.95	436.60	1690.76
	(31.30)	(42.88)	(25.82)	(100)

maintains cost per year was found of Rs,44311.70 member of dairy cooperative societies, while non-members of Rs, 37431.53. The net maintains cost of members was higher as compare to non-members.

The table further shows that overall average net returns from milk per animal was Rs. 24905.86 in case of non-members. The category-wise analysis shows that the net returns was found to be Rs. 20207.47 on small farmers, Rs. 27484.47 on marginal farmers and Rs. 24764.68 in landless families. It shows that the net returns from milk was lower in case of small farmers and higher on marginal farmers. It was due to lower maintenance cost per animal on small farmers.

The cost-benefit ratio which expresses the relationship between the unit cost and the proportionate return is another parameter of looking into the efficiency of dairy business.

The cost benefit ratio is the ratio between gross return to the net maintenance cost. The cost benefit ratio was estimated and the results are presented in **Table-4** shows that in case of members per family overall average income per rupee of investment was of Rs1:1.64.The income per rupee of investment in different categories was of Rs 1.45 on small farmers, Rs 1.61 on marginal farmers and Rs 1.75 in landless families. It shows that the income per rupee of

Table 3 : Gross return, maintenance cost-per year and net return of categories of members and non-members.

Category	Gross returns	Net maintenance Cost per year (in Rs.)	Net returns
	Members		
Small	69201.77	47592.44	21609.33
Marginal	70378.01	43717.59	26660.42
Landless	75913.40	43330.02	32583.38
Overall	72725.94	44311.70	28414.25
	Non-members		
Small	58752.61	38545.14	20207.47
Marginal	61890.78	34406.31	27484.47
Landless	63715.23	38950.55	24764.68
Overall	62337.39	37431.53	24905.86

Table 4 : Cost benefit ratio per animal members and non-members of dairy cooperatives societies.

Category	Net maintenance cost per year (in Rs.)	Gross Income (Rs.)	Cost benefit ratio	
	Members			
Small	47592.44	69201.77	1:	1.45
Marginal	43717.59	70378.01	1:	1.61
Landless	43330.02	75913.40	1:	1.75
Overall	44311.70	72725.94	1:	1.64
	Non-members			
Small	38545.14	58752.61	1:	1.51
Marginal	34406.31	61890.78	1:	1.78
Landless	38950.55	63715.23	1:	1.63
Overall	37431.53	62337.39	1:	1.66

investment was maximum in landless families. In case of non-members side the over all average cost benefit ratio was found 1:1.51 in small farmers, 1:1.78 marginal farmers and 1:1.63 landless. It show that the income per rupees of investment was higher in marginal farmers.

The table further reveals that the net returns per animal was highest in case of members as compared to non-members. It is advisable for non-members to become the members of the village level milk producer co-operative society, because they provide a guaranteed market for milk at a remunerative price, supply cattle feed at a reasonable cost and provide efficient veterinary and extension services for the milk producer's.

Table 5 indicated that the overall average benefit gained per family was of Rs. 789.86 i.e.17.52 per cent of the material supplied by Gangol Sahakari Dugdh Utpadak Sangh Ltd, Meerut. In case of small, marginal and landless categories, it was 14.65, 17.03 and 19.11 per cent, respectively. It shows that landless families got more concession from the Gangol Sahakari Dugdh Utpadak Sangh Ltd, Meerut in the value of the material supplied by Gangol Sahakari Dugdh Utpadak Sangh Ltd, Meerut District.

CONCLUSION

On the basis of findings it may be concluded that the cost of milk production per liter was found higher in members of dairy cooperative societies as compare to non members. The milk production per animal was higher in all categories of members as compare to non

Table 5 : Benefits derived by the members per family from Gangol Sahakari Dugdh Utpadak Sangh Ltd, Meerut during 2016-17.

Category	Concessional value (Rs.)	Market value	Benefit derived (concessional) (Rs.)	Percentage benefit
Small	4823.31	5651.19	827.88	14.65
Marginal	3960.75	4773.72	812.97	17.03
Landless	3204.51	3961.56	757.05	19.11
Overall	3780.35	4570.21	789.86	17.52

members. The gross return per animal was higher in all categories of members as compared to non members. The net return from milk per animal was higher in all categories of members as compared to non members. The cost benefit ratio was found higher in non members in comparison to members.

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Short communication

Socio-economic Status of Career Preferences of Girl Students in State Agriculture University in Uttar Pradesh

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The role of women in Indian agriculture is going to be more pronounced in future as girls now are dominating in agriculture education. It has been reported that 50% of the students in agricultural universities across the country are girls and in some important agricultural universities their share is around 60%.Women in agriculture professionals had greater access to both farm women and farm communities as compared to their male counterparts and thus aid in better technology transfer[1]. Considering the socio-cultural aspects, there is a need to encourage and increase girl students from rural areas as they are more tuned to serve in rural areas. The study was conducted in three State Agriculture Universities in Uttar Pradesh, C.S.A.U.A. &T Kanpur, S.V.P.U.A. &T, Meerut; N.D.U.A. & T. Kumarganj Faizabad. An equal number of girls student 40 was from each universities. An interview schedule was prepared keeping in view the objective and variables to be studied. The personal interview method will be employed for data collection from the respondents of three selected universities. The data were collected by personal interview through structured schedule and analysed using statistical techniques like percentage, standard deviation and correlation of coefficient.

1. Socio-economic profile of career preferences of girl students:

It is obvious from the Table1 that maximum number of the respondents (68.33%) were observed in the category of 21 to 25 years of age followed by less than 20 years (18.33%) and 26 and above (13.34%) respectively. so, its focuses that the agriculture girl students of 21 to 25 years of age category were observed to be more. The reveals that the girl's students were found in the B.Sc. agriculture (56.66%), M.Sc. (29.17%) and Ph.D. students of girls (14.17%) respectively. Half of the respondents (52.2%) belonged to general categories caste while the backward caste and scheduled caste were 30.83% and 16.66% respectively. It is apparent from the data given in Table 1 pertaining to the type of house possession that 95.00 percentage respondents were found having their houses of pucca types, and 5 percentage were reported such who had mixed houses.

It is obvious from Table 3 that maximum (47.5%) of the respondents were belongs to annual income group category of Rs. 200001 to 600000 followed by other categories viz., 18.34 percentage (600001 to 800000), 17.5 percentage (Up to 200000), 10.00 percentage (800001 to 1000000) and 6.66 percentage (1000001 to above) respectively.

Table 3 Distribution of respondents according to family annual income (Rs.)

S. No.	Income categories	Respondents (No.)	Percentage
1.	Up to 200000	21	17.5
2.	200001 to 600000	57	47.5
3.	600001 to 800000	22	18.34
4.	800001 to 1000000	12	10
5.	1000001 to above	8	6.66

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Table 1 Distribution of respondents according to their age, education, caste and housing pattern

S. No.	Age group	Respondent	Percentage
1	**Age houses**		
	Less than 20 year	22	18.33
	21 to 25 Years	82	68.33
	26 Years and above	16	13.34
2	**Education**		
	B.Sc. (Ag.) I, II, III, IV Year	68	56.66
	M.Sc. (Ag.) I, II Year	35	29.17
	Ph.D. (Ag) I, II, III Year	17	14.17
3	**Caste**		
	General caste	63	52.5
	Backward caste	37	30.83
	Scheduled caste/Scheduled Tribes	20	16.66
4	**House Pattern**		
	Hut	0	00.00
	Kaccha	0	00.00
	Mixed	6	5.00
	Pucca	114	95.00

The main and subsidiary family occupation of the respondents. In case of main occupation the highest number of respondents (95%) reported in services as their main business, (34.16%) and agriculture (25%) respectively. similarly in case of subsidiary occupation, maximum (14.16%) reported agriculture as their main subsidiary occupation followed by business, (5.83%) and services (3.33%) respectively (Table 2).

Table 2 Distribution of respondents according to family occupation

S. No.	Categories	Respondents									
		Father		Mother		Brother		Total		Percent	
		M	S	M	S	M	S	M	S	M	S
1.	Agriculture	18	17	10	0	1	0	30	17	25	14.16
2.	Service	80	2	19	1	15	1	114	4	95	3.33
3.	Business	22	4	12	3	6	0	41	7	34.16	5.83
	Total	**120**	**23**	**41**	4	**22**	**1**	**185**	**28**	**154.16**	**23.32**

ORGANIC HORTICULTURE : CHALLENGES AND FUTURE POSSIBILITIES IN INDIAN SCENARIO

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Abstract

In India, only traditional agriculture was followed without intervention of synthetic and chemical fertilizers and pesticides. There was threatening to food security to fulfill the hunger of the population and frequent climatic aberrations during late 1960s. After the green revolution, agricultural production has been increased by using high amount of chemical. Organic method of agriculture is used to produce high quality products (Fruits, vegetables and other food materials) without any bad effect on soil nutrient and ecosystem. This method has been popularized very rapidly and covered 20 to 30% of total agricultural land of India due to high demand of organic agricultural product (fruits, vegetables, cereals, pulses and other food materials). Soil degradation, high pest-disease-weed infestation, more water consumption and non- judicious use of inputs, unfavorable price and with several natural and manmade issues, the farming turned to be unworthy for farmers. Under these circumstances, there was a need to search the potential of organic farming in our country as the practice was emerging in several countries all over the world for the last two decades. India also started its journey towards organic farming to meet domestic and export need of organic produce during end of last century.

Keywords: Environment, Green revolution, INM, Organic Horticulture, Sustainability

INTRODUCTION

Organic farming is a crop production method respecting the rules of the nature. Organic farming for different crops expanded rapidly and practices in the case of fruits and vegetables also has been started in 1990s.The British botanist, sir Albert Howard often called "the father of modern organic agriculture" studied traditional farming practices in Bengal. In 1972, the International Federation of Organic Agriculture Movement (IFOAM), was founded in France, certification started in 1990.Organic farming is targeted to produce nutritive, healthy and pollution free food. It maximizes the use of on farm resources and minimizes the use of off-farm resources. It is social profit oriented, than profit oriented. In organic farming entire system i.e, plant, animal, soil, water and micro-organism are to be protected.

Organic horticulture is the science and art of growing fruits, vegetables, flowers, or ornamental plants by following the essential principles of organic agriculture in soil building and conservation, pest management, and heirloom variety preservation.

As of March 2014, India had 4.72 million ha under an organic certification process, including 0.6 million ha of cultivated agricultural land and 4.12 million ha of wild harvest collection forest area. During 2012–2013, India exported 165,262 million tons of organic products across 135 commodities valued at $312 million. The domestic market for organic commodities is also growing at an annual growth rate of 15%–20%. The crops grown organically include cashew nut, spices, cotton, rice, sugarcane, pineapple, passion fruit, groundnut, sunflower, millet, vegetables, wheat castor, mustard, walnut, tea, coffee, banana, and mango. Institutional support for organic exports from India was created by the launch of the National Program for Organic Production (NPOP) by the Agriculture and Processed Food Export Development Authority (APEDA), Ministry of Commerce.[3]

India with more than 28.2 million tonnes of fruits and 66 million tonnes of vegetables is the second largest producer of fruits and vegetables in the world next only to Brazil and China. However, per capita consumption of fruits and vegetables in India is only around 46kg and 130g against a minimum of about 92g and 300g respectively recommended

by Indian Council of Medical Research and National Institute of Nutrition, Hyderabad. With the present level of population, the annual requirement of fruits and vegetables will be of the order of 32.58million tonnes and 83million tonnes respectively. To meet this requirement the National Commission on Agriculture has projected an area of 4m.ha. and 8m.ha. under fruits and vegetable crops respectively by 2000 A.D. [2]

OBJECTIVES

1. To minimize all forms of pollution that may result from agricultural practices
2. To encourage and enhance biological cycles involving microorganisms, soil flora and fauna, plants and animals.
3. To produce healthy, nutritious and quality food.
4. To maintain and enhance long-term fertility of soils.
5. To help in soil and water conservation.
6. To use on farm resources as far as possible.
7. To preserve and enhance traditional and indigenous knowledge in farming, varieties.
8. To maintain genetic diversity

Limitations of organic farming

1. Low amount of nutrients and high C : N ratio of different organic residues.
2. Market and Infrastructural problems and lack of target (institutional) groups.
3. Control of weeds.
4. Scarcity of biomass.
5. High input costs.
6. Lack of awareness.
7. Benchmark survey.
8. Certifying oriented problems.

Present status of organic farming in India

1. Ranks 33rd in the world in terms of area under organic cultivation.
2. Ranks 88 th in the world in terms of ratio of agriculture land under organic crops to total farming area.
3. Cultivated area under certification is 3,39,113Ha (all crops), main vegetables grown are Okra, Brinjal, Tomato, Potato, Onion, Garlic.
4. Total area cultivated 2.8 million Ha.

Approaches for organic farming

1. Nature farming : 'do nothing' approach
2. Ecological agriculture : tools used are biofertilizers , botanical pesticides, bio-control agents, stress resistant varieties, vermi-compost etc.
3. Rishi krishi :
   angara - bhoomi sanskar, to make soil fertile.
   amrit pani - for seed treatment.
   pancha gavya - for vegetative and reproductive growth.
   biodynamic farming - for micronutrient supply.

GENERAL INFORMATION OF ORGANIC HORTICULTURE

It is estimated that all the horticulture crops put together cover nearly 11-6 million hectares area with an annual production of 91 million tonnes. Though these crops occupy hardly 7% of the cropped area they contribute over 18% to the gross agricultural output in the country.

Horticulture involves five areas of study. These areas are floriculture (includes production and marketing of floral crops), landscape horticulture (includes production, marketing and maintenance of landscape plants), olericulture (includes production and marketing of vegetables), pomology (includes production and marketing of fruits), and postharvest physiology (involves maintaining quality and preventing spoilage of horticultural crops). All of these can be, and sometimes are, pursued according to the principles of organic cultivation.

Organic horticulture (or organic gardening) is based on knowledge and techniques gathered over thousands of years. In general terms, organic horticulture involves natural processes, often taking place over extended periods of time, and a sustainable, holistic approach-while chemical-based horticulture focuses on immediate, isolated effects and reductionist strategies.

Soil management

"Soil is the result of interaction between three equal partners: the a-biotic components of the soil, living organisms and environmental components (temperature, water, air). Each of these brings different assets to the partnership, and each makes a unique value contribution to the whole. The synthesis of all contributions - soil - is greater than the sum of its parts. Soil must be understood and managed from this holistic perspective. [1]

Nutrient management

Principally, animal manures, compost, green manures, bio-fertilizers, mixed organic fertilizers are used in organic farming. Nitrogen is provided by legume crops having nitrogen fixing symbiotic bacteria and by soil habiting non-symbiotic bacteria. Enrichment of phosphorus in soil is done by incorporation of rock-phosphate, VAM (Vesicular Arbuscular Mycorrhiza - solublises phosphorus for greater availability to the plants) and VAM treated compost. Potassium is provided by wood ash, sea weeds, tobacco stem; used alone or in combination with others. Beside it permanent mulching layer reduces the potassium leaching. Apply lime 2-3 months before planting to correct soil acidity.

Pest, disease and weed management

Suitable crop rotations, green manuring, use of balanced fertilizers, proper care during nursery, mulching etc. play important role to protect the crop from insect pest and disease. The following practices are recommended :

1. Use trichoderma for seed treatment
2. Use resistant varieties
3. Use disease free planting material
4. Use mulching for those vegetables whose fruits touches the soil
5. Clean the crop residue
6. Summer fallowing and flooding
7. Use spray Bt, NPV, Beauveria
8. Use insect traps- such as pheromone trap, light trap, yellow trap, sticky trap
9. Use botanicals like neem, garlic etc.
10. Use trap crops to misguide the insect and protect the main crop.

Research conducted in organic horticulture : Various research work is being carried out at different research institutes in India mainly focusing on the following areas :

Evaluation of fertilizer for organically-grown vegetables

Evaluation of the stale seedbed technique for leafy vegetable production
Evaluation of biopesticides for powdery mildew
Aerated compost tea and other alternative treatments for disease control in horticultural crops
Evaluation of biodegradable and photodegradable mulch

CERTIFICATION PROCESS OF ORGANIC FOOD PRODUCTION

Certification process in organic horticulture is similar to certification process in organic agriculture.

To satisfy the consumers and guarantee that the produce is totally organic. Certification agency conducts inspection that minimum requirements prescribed for organic agriculture is fully met and issues certificate. Certificate is given for current year's harvest only and hence annual certification is required. Cost of certification is high but products can get >20% returns than conventional if there is proper market. At international level, basic standards are defined by IFOAM, evaluation will be done by accredited private agencies. National standard in India is set by NPOP, effort is done to standardize it with EU standards, national accreditation done by APEDA and other commodity boards.

CONCLUSION

Organic farming helps in rejuvenating the degraded soil and ensure sustainability of crop production .Hence its to be promoted. Only 1% organic vegetables are exported now more potential is there as more demand in market, and consumers are ready to pay premium prices.

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DETECTION OF ARSENIC LEVEL IN VARIOUS FIELD SAMPLES IN FAIZABAD DISTRICT OF EASTERN UTTAR PRADESH

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Abstract

The study designed to detect arsenic level in water, soil & poultry meat in the five different locations in Faizabad district of eastern Uttar Pradesh and correlated with soil and poultry meat arsenic content. In this study, 80 samples of each water, soil and poultry meat were collected from five different areas. Arsenic contents of samples were detected by Hydride Generation Atomic Absorption Spectrophotometer (HG-AAS). The average arsenic contents of water, soil and poultry meat of different areas are 0.00550±0.00304, 5.5500±2.9810 and 0.17924±0.05247µg/g respectively.Analysis of 80 drinking water samples revealed that Arsenic concentration was above MPL (10µg/l) in 11.25% .The Arsenic content in drinking water ranged from 1.049-13.879µg/l with a mean value of 5.5312±3.0407µg/l in Faizabad district. Analysis of 80 soil samples revealed that Arsenic concentrationµ was above MPL (10µg/g) in 12.50%. The Arsenic content in soil ranged from 0.866-13.365µg/g with a mean value of 5.550±2.9810µg/g in Faizabad district. Analysis of 80 poultry meat samples revealed that Arsenic concentration was below MPL (0.50µg/g) in all the samples and Arsenic content in poultry meat ranged from 0.0882-0.3129µg/g with a mean value of 0.17924±0.05247µg/g in Faizabad district.The correlation matrix showed that soil and poultry meat arsenic content was significantly correlated with water arsenic content. Correlation analysis showed a significant positive correlation between drinking water, soil and poultry meat (Correlation coefficient r=0.623, p<0.01) and correlation was also found positive at (Correlation coefficient r=0.497, p<0.05).

Keywords: Hydride Generation Atomic Absorption Spectrophotometer (HG-AAS), Maximum Permissible Limit (MPL)

Introduction

Arsenic is one of the most toxic metals derived from the natural environment. The major cause of animal arsenic toxicity is from contamination of drinking water from natural geological sources rather than from mining, smelting or agricultural sources (pesticides or fertilizers).[1] Arsenic is semi metallic in nature and widely present in the earth-crust in the forms of oxides or sulfides or as a salt of iron, sodium, calcium, copper etc. Arsenic and its compound are well known for its toxicity and carcinogenicity.[2] It is a widespread pollutant in various regions of the world.[3] Weathering of rocks converts arsenic sulfides to arsenic trioxide, which enters the arsenic cycle as dust or by dissolution in rain, rivers, or groundwater.[4] The occurrence of high concentrations of arsenic in groundwater used for drinking purpose has been recognized as a major public health concern in several parts of the world. Arsenic has been found to accumulate in the plant tissues and results in reduction in their bio-mass.[5] Presently, the extent of groundwater arsenic contamination in West Bengal has reached an alarming situation as nine districts of West Bengal have been reported to have ground water arsenic concentrations above 50µg/l and several people have been affected by arsenic poisoning.[6] Whereas food represents a further potential exposure pathway to arsenic in instance where crops are irrigated with high arsenic ground water, grown in contaminated fields or where food is cooked using arsenic contaminated water.[7,8,9]

Routes of As-assimilation could be through ingestion and inhalation, while some degree of absorption also occurs by skin.[10] It is readily absorbed in the gastrointestinal tract.[11] About 50% of the ingested dose may be eliminated in the urine in three to five days. In acute poisoning electro-thermal atomic absorption spectrometry studies show that the highest concentration of arsenic is in the kidneys and liver.[12]

Arsenic may be present in the organic or inorganic forms.[13] Of the inorganic forms, arsenite (trivalent) and arsenate (pentavalent) are the two most prevalent and potential dangerous forms, while organic form of organoarsenicals is of importance.[14, 15] In India Arsenic is naturally derived mainly from eroded Himalayan sediments, and is believed to enter in the solution following reductive release from solid phases under an aerobic condition.[16] In chronic arsenic ingestion, arsenic accumulates in the liver, kidneys, heart and lungs and smaller amounts in the muscles, nervous system, gastrointestinal tract and spleen. Though most arsenic is cleared from these sites, residual amounts remain in the keratin-rich tissues, nails, hair and skin. After about two weeks of ingestion, arsenic is deposited in the hair and nails. Chronic exposure to inorganic arsenic can lead to cancer of the skin, lungs, bladder and liver. [17]

Materials and Methods

This study was designed to detect the Arsenic level in various field samples in Faizabad district of eastern Uttar Pradesh. The major objectives are:-

A. To carry out the socio-toxicological survey study in the different locations of Faizabad district.
B. To collect the various field samples like water, soil & poultry meat from the different identified places of Faizabad district of eastern Uttar Pradesh.
C. To standardize extraction procedure and the processed aliquots used for the estimation of arsenic by Hydride Generation Atomic Absorption Spectrophotometer (HG-AAS).

2.1 Socio-toxicological survey:

A survey was carried out to assess the socio-economic and public health importance of Arsenic toxicity in animals. This survey was done to identify the Arsenic prone area. For that purpose samples of water, soil and poultry meat were collected in Faizabad district of eastern Uttar Pradesh. The obtained information was recorded to correlate the toxicity of Arsenic in animals exposed to arsenic through contaminated water, soil and poultry meat. 80 samples of each water, soil and poultry meat were collected from the different identified locations of Faizabad district of Eastern U.P

Water samples of about 125 ml were collected from different water sources in polyethylene vials, these vials are pre-treated with clean up procedure. Before filling, rinse the bottles two or three times with the water being collected. After collection, sample is acidified with conc. nitric acid to a pH below 2 to minimize precipitation and adsorption of heavy metals on the container walls.[18] After acidifying sample transfer to the lab and kept in refrigerator at 4°C temperature until further analysis.[19]

Soil samples were collected 100 g each time at the locations used for fodder crops. Soil was collected from a depth range of approximately 0–15 cm. The samples were dried at 110 °C, ground to pass through a 200-mesh sieve, and transferred to high-density polyethylene (HDPE) bottles and were properly labeled.[20] They were immediately sent to

INCIDENCE AND INHERITANCE OF CERTAIN REPRODUCTIVE PROBLEMS IN HARYANA CATTLE

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(RESEARCH PAPER IN ANIMAL HUSBANDRY)

Abstract

Hariana is known as best draught breed of zebu cattle and also known for its endurance, resistance to tropical diseases, tick resistance and drought resistance. The present investigation was carried out on 258 Hariana cows for their 983 calving records spread over a period of 25 years from 1992 to 2016 maintained at State Livestock cum Agricultural Farm, Hastinapur (Meerut) UP to study the incidence of lactation disorders. The data were collected on different lactation disorders and other relevant information from different records, registers and pedigree cum history sheets and was classified into 4 periods of 25 years, 04 seasons of calving based on climatological parameters and 5 parity of lactation and subjected to statistical analysis. The study revealed that overall incidence of abnormal births was 4.7 percent and significantly affected by the period of calving. There is no significant effect of genetic factor on the incidences of utero-vaginal prolapse and retention of placenta. In conclusion, the parity affects incidence of utero-vaginal disorders significantly and do not have significant effect on abnormal births, while season of calving significantly affects abnormal births.

Keywords: *Reproductive disorders, Cattle, Retention of Placenta, Metritis*

Introduction

India is an agrarian country, said to live in villages and about 70% of its population engaged in agriculture in one or the other way with livestock as the integral part of agriculture. Animal husbandry is a component of agricultural economy playing its crucial role in development of the country. This sector may be helpful in reducing the poverty in rural India. Animal products contribute 27% of the agriculture output and the value of output from livestock sector as a whole increased three-fold (Birthal et al, 1999 and Dastagiri, 2010). Globally, India ranks first in milk production and during the year 2017-18, there is 6.6% increase in milk production to 176.35 million tonnes (Anon., 2018).

The various sources of losses from disease are the reduced milk yield, discarding of milk from diseased cow, drugs and veterinary services involved in treatment of diseased cow, requirement of more labor, premature loss of cows due to death or culling at low price, reduced milk quality and finally reduced genetic gain. The premature culling of a cow due to lactation disorders amounts to a great loses not only of the milk production but also of the offspring due to which a best dairy cow with high genetic merit may not replace itself. This reduces the genetic gain and hence lowers the rate of genetic improvement. The most important lactation disorders are the utero-vaginal disorders, breeding problems, and udder problems. These disorders do not only result into low milk production but also lowers the fertility and longevity of the animals and hence reduces the income to dairy farmers in a number of ways. There had been unusual rate of genetic improvement for yield traits of dairy cattle through breeding strategies. The present study was conducted to know the incidence and inheritance of lactation disorders in Haryana cattle.

Materials and Methods

Source of Data

The present study was carried out on Hariana cows maintained at Hastinapur (Meerut), Uttar Pradesh. The data were collected from the history sheets cum pedigree sheets, health register, culling reports, mortality register and fertility records of the cows. A total of 983 calving records of 258 adult cows were recorded over a period of 25 years (1992-2016). The calving records of cows which have completed at least one lactation were included in the present study.

Location and Climate of the farm

The Govt. livestock farm, Hastinapur is situated about 30 km north-east of Meerut (U.P.) on the edge of Holley river Ganga. The climate of the farm is typically tropical in nature. There is daily variation in temperature reaching as high as 43^0C during summer months (April-June) followed by humid but less hot monsoon period from July to September. The cold weather starts from December ending in March during which the temperature ranges from 4 to 30 ^{0}C. Thus, the animals of this farm faced great climatic stress of both hot and cold.

Breeding and Management Practices

The breeding policy at this farm was selective breeding with Hariana bulls from high yielding dams. Selection and culling criterion of females as well as the selection of young male calves for breeding was on the basis of dam's milk yield. The nutritional requirements were met by supplying a balanced ration of green and dry fodder supplemented with concentrate. The cows were stall fed along with grazing. Landholding of farm was 400 acres and used for fodder production and grazing of animals. The animals were also fed the mineral mixture according to age group. Concentrate feeding to milking cows was based on their milk production. There were separate sheds for animals of different age groups. The animals were given protection from adverse climatic conditions i.e. from cold and heat. The milking cows were hand milked twice a day. The udder and teats of the milking animals were washed thoroughly before milking. The milk recording was also done by the milk recorder for individual cow both the times. Sick animal were identified and given the proper treatment by the veterinarian. The prophylactic measures were adopted by vaccinating the animals for different diseases as per norms.

Data collection and description

The data were collected on different traits of lactation disorders and disposal pattern of adult cows from different registers/reports. The data like cow number, sire number, dates of different services in different lactations, date of calving in different lactations, sex and type of calf born in different lactations, milk yield in different lactations, number of days under treatment for various disorders, date of death of cows and date of culling of cows were recorded to generate some characters and to feed the data for statistical analysis. The reproductive disorders like calving problems, utero-vaginal prolapse, retention of placenta and metritis were collected from health/treatment register and breeding records or service records.

***Data Classification*:** The data spread over a period of 25 years for the cows belonging to different parity of lactation calved in different seasons of year were classified into periods, parity order (lactation number) and season of calving.

a) ***Parity of lactation***: The parities of lactations were considered up to the last parity available in the history sheet of cow. The numbers of cows in fifth and above parities of lactation being less were combined in to one group as 5 & above.

b) ***Period of calving***: The complete data of 25 years were divided in to 5 periods. This was done considering that management levels do not change during some years and the change accumulated over 4-5 years may become important in

influencing the performance records of the animals. The following classification of 25 years was done as:

Years	Period code
1992 – 1996	1
1997 – 2001	2
2002 – 2006	3
2007 – 2011	4
2012 – 2016	5

c) ***Season of calving***: The climatic conditions are different during different months of a year but these are more or less similar for 2-3 consecutive months and hence the 12 month of a year were grouped into four seasons as under:

Months	Season	Season code
December-March	Winter	1
April-June	Summer	2
July-September	Rainy	3
October-November	Autumn	4

Statistical analysis: The incidence of various lactation disorders were calculated for different levels of parity, period and season of calving as the percentage of cows affected with a particular disorder. The significance of the effect of various non genetic factors viz. parity, period and season of calving on various lactation disorders and disposal traits were estimated by conducting the analysis of variance (F-test).

Results and Discussion

Incidence of lactation disorders: The overall average values of various lactation disorders as well as their average values in relation to the levels of different non genetic factors viz. parity order, period and season of calving and the results of analysis of variance (ANOVA) showing the significance of different non genetic factors have been presented in tables 1-4.

Abnormal calving*:* The overall incidence of abnormal birth was 4.7 percent (Table 1). Previous studies (Bhattacharya and Buchoo, 2008; Kumari *et al.,* 2015 and Sardar *et al.,* 2015). On contrary, higher incidence than the present study (Tesfaye and Shamble, 2013; Hadush *et al.* 2013; De Amicis *et.al*., 2018), whereas low incidence have been reported by Tomar and Singh (1973) for Hariana cows bred to bulls of different breeds (1.1-3.6%), Rawal and Tomar (1996a) for Sahiwal breed (3.5%) and Sangeeta *et al*. (2002) for crossbred cow (3.03%). The incidence of abnormal calving varied from 3.5 percent (5^{th} lactation) to 6.6 percent (I^{st} lactation) among the cows of different lactations and the incidence was higher in first calvers than older cows. This may be because genital organs of first calf heifers are not well accustomed to the normal act of parturition. Higher incidence of abnormal births among younger cows have also been reported by Singh and Jain (1997) whereas Arun *et al.* (1995) have found that the incidence was higher in older cows but no trend along parity order of lactation was observed by Mukherjee and Tomar (2000). There was no significant relation between the effect of parity order and abnormal calving. This is in agreement with previous studies (Banik and Naskar, 2006; Tesfaye and Shamble, 2013) while significant effect of parity order on abnormal calving was reported by Hadush *et al.*, 2013 and Sardar *et al.*, 2015. The period of calving was found to influence significantly ($P<0.01$) the incidence of abnormal calving in this study (Table 2) ranging 2.5% to 8.3%. Similar to this study, previous reports (Singh *et al.*, 2002; Bhattacharya and Buchoo, 2008) were in agreement while Singh and Jain (1997) could not find significant effect of period of calving on the incidence of abnormal births

The rate of abnormal calving was found to be highest among summer calvers (8.3%) while it was lowest (2.7%) among those calved during autumn season and statistically significant. Higher incidence of abnormal births among summer calvers have also been reported previously (Arun *et al*., 1995). This might be because the cows with inadequate feed supply and reduced feed consumption during summer abort as a protective mechanism to conserve their own body reserve (Roberts, 1971).

Utero-vaginal prolapse*:* The incidence of Uterovaginal prolapsed was 3.35 percent, which was similar to previous studies (Bhattacharya and Buchoo, 2008). However, low incidence have also been reported by Sangeeta et al (2002) in crossbred cattle (0.1%), Hadush *et al.* 2013 (1.9%) and Sardar *et al., 2015* (0.66%). There was no significant relationship between prolapsed and parity of animals. Contrary to this, Hadush *et al.* 2013 and Sardar *et al., 2015* reported that parity of lactation had significant effect on the incidence of prolapse.

Retention of placenta: The overall incidence of retention of placenta in the present study was 5.80%. Similar to present study, Bhattacharya and Buchoo (2008) have reported almost same incidence of retention of placenta. Contrary to present findings, low incidence of retained placenta have been reported by Sangeeta *et al.* (2002), Hadush *et al.*(2013) and Sardar *et al.* (2015), while high incidence of retention of placenta was reported by Tesfaye and Shamble (2013), Kumari *et al.*, 2015) and Khan *et al.*, 2016). There was no significant difference between incidences of retention of placenta with season of calving and parity of animals.

Metritis: In the present study, overall 7.22 percent cows developed metritis following parturition (Table 3). Similar to present findings, previous studies (Bhattacharya and Buchoo, 2008; Hadush *et al.*, 2013; Khan *et al*., 2016) have also reported similar incidences. The parity of lactation had significant effect on the incidence of metritis. The cows calving during rainy season had high incidence of metritis (9.35%) and low incidence in the cows calved during summer seasons (5.39%). The high incidence during rainy season may be due to the reason that there are more chances of septic condition during rainy season particularly when the placenta is removed manually. Tomar and Tripathi (1994) had also reported the significant effect of season of calving, also being high during rainy season. In conclusion, the parity affects incidence of utero-vaginal disorders significantly and do not have significant effect on abnormal births, while season of calving significantly affects abnormal births. The high incidences of reproductive problems in the herd may be the reason of culling in the animals.

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Conflict of interest statement

The authors do not have any conflict of interests.

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Table 1: Incidence (%) of abnormal births and sex ratio (% males) in relation to non genetic factors.

Effects	Total births	Abnormal births		Male births		Female births	Total normal births
		No.	%	No.	Sex ratio (%)		
Lact-1	258	17	6.6	110	45.6	131	241
2	202	9	4.5	98	50.8	95	193
3	162	5	3.1	72	45.9	85	157
4	129	7	5.4	53	43.4	69	122
5	232	8	3.5	109	48.7	115	224
Period							
1	86	6	7.0	34	42.5	46	80
2	197	5	2.5	92	47.9	100	192
3	303	10	3.3	140	47.8	153	293
4	217	18	8.3	94	47.2	105	199
5	180	7	3.9	82	47.4	91	173
Season							
Winter	417	18	4.3	199	49.9	200	399
Summer	204	17	8.3	80	42.8	107	187
Rainy	214	7	3.3	96	46.4	111	207
Autumn	148	4	2.7	67	46.5	77	144
Overall	**983**	**46**	**4.7**	**442**	**47.2**	**495**	**937**

Table 2: ANOVA indicating the effect of non-genetic factors on abnormal births and sex ratio. (Mean Square Values).

Sources of variation	Degree of freedom	Abnormal calving	Sex ratio
Lactations	4	0.0638	0.1228
Periods	4	0.1792**	0.0699
Seasons	3	0.1698*	0.5201*
Error		0.0491(971)	0.1919 (925)

* P<0.05, ** P<0.01

Table 3: Incidence of utero-vaginal disorders (%) in relation to non-genetic factors

Effects	No of Observations	Prolapse	Retention of Placenta	Metritis
Overall	983	3.35 (33)	5.80 (57)	7.22 (71)
Parity				
1	258	3.88 (10)	6.59 (17)	7.75 (20)
2	202	2.97 (6)	5.94 (12)	11.88 (24)
3	162	3.09 (5)	4.94 (8)	6.79 (11)
4	129	3.10 (4)	3.88 (5)	5.43 (7)
5	232	3.45 (8)	6.47 (15)	3.88 (9)
Period				
1	86	4.65 (4)	5.81 (5)	9.30 (8)
2	197	3.55 (7)	5.08 (10)	7.61 (15)
3	303	3.63 (11)	5.61 (17)	6.60 (20)
4	217	2.76 (6)	6.91 (15)	6.91 (15)

5	180	2.78 (5)	5.56 (10)	7.22 (13)
Season				
Winter	417	2.40 (10)	5.28 (22)	7.19 (30)
Summer	204	4.41 (9)	7.35 (15)	5.39 (11)
Rainy	214	4.21 (9)	6.07 (13)	9.35 (20)
Autumn	148	3.38 (5)	4.73 (7)	6.76 (10)

Figures in parenthesis are the number of affected cows.

Table 4: ANOVA indicating the effect of environmental factors on various utero-vaginal disorders (Mean Square values).

Sources of variation	DF	Prolapse	Retention of Placenta	Metritis
Lactations	4	0.0084	0.0098	0.2012*
Periods	4	0.0052	0.0684	0.0008
Seasons	3	0.0598	0.0477	0.2275*
Error	971	0.0496	0.0698	0.0659

* P< 0.05

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Integrated Plant Nutrient Supply and Future Challenges.

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ABSTRACT

Integrated plant nutrient supply involves monitoring all the path ways of plant nutrient supply in crops and cropping systems and calls for judicious combination of fertilizer, bio-fertilizer and organic manures. Organic sources of plan nutrients including growing of legumes in cropping systems, green manures, crop residues, organic manures (FYM, compost, Vermi compost, biogas slurry, phosphor compost, bio compost, press mud, cakes etc) and bio-fertilizers. The available information has shown that by addition of organic manures in addition of fertilizers (add-on series) good crop yields were sustained over long periods as compared to a decline in crop yields when only fertilizers were applied, especially when N alone was applied. The data from replacement series of trials shown that in most cropping systems specially in rice wheat, rice wheat sugarcane systems application on 50% N through green manures, FYM or crop residues or 50% recommended dose of fertilizer (RDF) (NPK) to Kharif rice and 100% recommended dose of fertilizer to Rabi crop (wheat) gave the same yield as obtained with 100% recommended dose of fertilizer of Kharif and Rabi crops (rice/wheat). These results show that 25% NPK applied to the cropping system can be saved. Further addition of organic manures both in add-on and replacement series always improved chemical, physical and biological properties of soils. As regards bio-fertilizers usefulness of rhizobial inoculation of pulses and leguminous oilseeds (soya bean, groundnut) along with recommended dose of fertilizer (NPK) has been proved beyond doubt. Rhizobial inoculation helps not only in increasing crop yields but also increasing the amount of an left after succeeding crops use of cultures of PSO's [phosphate solubilising bacteria (PSB) and phosphate solubilising fungi (PSF)] can help in making native soil P as well as rock phosphate P move available to crops. It's benefits are seen even with DAP or SSP. Azotobacter and Azospirillum cultures can

PREVALENCE OF BIOFILM FORMING *STAPHYLOCOCCUS AUREUS* IN CLINICAL SPECIMEN FROM HUMAN AND ANIMALS

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Abstract

Staphylococcus aureus is considered as a potential cause of wide variety of infections in human and animals. Biofilm formation not only protects the bacteria from host immune cells but also protect it from antimicrobial drugs thus facilitating the survival of bacteria for a longer period. The aim of this study was to determine the prevalence of biofilm formation among *S. aureus* isolated from clinical samples of human and animals in and around Mathura, India. In the present study, a total of 175 clinical samples from human (75) and animals (100) were collected and processed for isolation of *S. aureus*. All the *S. aureus* isolated were further confirmed by morphological, standard biochemical tests, and molecular tests. Biofilm formation ability of *S. aureus* isolates were examined by Congo red agar (CRA). A total of 175 samples were collected from animals and human, out of them, 78 (44.57%) samples were confirmed as *S. aureus* on the basis of cultural, morphological, biochemical and molecular characteristics. All the 78 isolates were tested for slime production using congo red agar method and only 47 (23 from human and 24 from animals) were found positive for biofilm formation. From the study, it can be concluded that, there is high prevalence of *S. aureus* infections in wounds / abscesses in human and animals and concurrent biofilm formation. High level of biofilm forming *Staphylococcus aureus* isolates in human and animal population may play a key role in the transmission of these microorganisms.

Keywords: Biofilm formation, Congo red dye, Prevalence, *Staphylococcus aureus*

Introduction

Staphylococcus aureus is a leading cause of infections in human as well as animals [1-3]. It may cause variety of infections ranging from minor skin infections to chronic systemic infections and sometimes failures of treatment [4]. This ability of bacterium is mainly due to the acquisition of resistance to multiple antimicrobials, virulence and capability to produce biofilms [5-7]. Biofilms are the extracellular polymeric substances, which provide the protection from host immune defense and space for the growth of bacterial, thus facilitating the survival of bacteria for a longer period. Infection due to biofilm producing *S. aureus* is more dangerous in comparison to that of non–biofilm producing *S. aureus* because bacteria within the biofilm are also protected from the antimicrobial agents leading to failure of treatment and repeated infections [8].

In a resource-limited country like India, the prevalence and early detection of biofilm forming *S. aureus* in clinical isolates is essential for the prevention and management of infections in humans and animals. Although previous studies have demonstrated the prevalence of *S. aureus* [2,3,5], limited knowledge about prevalence of biofilm forming *S. aureus* is available in clinical samples, especially in human and animal's infections. In the present study, authors aim to detect the prevalence of biofilm forming *S. aureus* in clinical isolates of man and animals in medical and veterinary practices in and around Mathura, India.

Materials and Methods

2.1. Sample source and collection

A total of 175 samples were collected during the study, out of them 75 samples were from humans consisting of pus samples from wounds, post-operative wounds, skin abscess, while 100 samples from animals from different sources such as abscesses, post-operative wounds, wounds etc. from the cattle, buffalo and dogs presented to the Veterinary Clinical Complex (VCC), DUVASU, nearby Goushalas and during clinical camps in and around Mathura, India**.** All the pus samples were collected with the help of sterilized swabs and immediately transferred to Tryptose soya broth (Hi Media, India) with 6.5% NaCl (Merck, India) for further processing.

2.2. Isolation and identification of *S. aureus*

All the samples were cultured on Nutrient agar media (Himedia, India) containing 6.5% Sodium Chloride. The presumptive Staphylococcus colonies (golden, round, smooth, glistening, opaque) were subjected to Gram's staining, biochemical tests, including mannitol fermentation, positive catalase and negative oxidase reaction [9].

2.3 DNA Extraction and PCR assay:

The DNA of all isolates was extracted using the phenol chloroform method as described previously (Sambrook and Russel, 2001). Concentration of DNA in each extract was measured using Nanodrop 1000 (NanoDrop). PCR primers for nucA gene and conditions of PCR have been described previously [10].

2.4. Screening of biofilm production:

The *in vitro* biofilm production was measured using phenotypic assays like Congo Red Agar (CRA) method. The biofilm producing strains were screened by qualitative methods like Congo Red Agar (CRA) method. All the confirmed *S. aureus* were grown on Congo red agar plates for 24h at 37°C and analyzed as described previously [11]. Black and brown colonies were regarded as slime producer isolates, while red and dark red colonies classified as non-biofilm producing strains.

Results and Discussion

Out of 175 clinical samples of wounds/ abscesses collected from human (75) and animals (100), 78 (44.57%) were positive for *S. aureus.* The prevalence of *S. aureus* in human and animal samples separately was found 61.3% and 32% respectively. All the 78 *S. aureus* isolated strains were showing cultural characteristics producing golden yellow colour colonies on Nutrient agar medium (Fig 1) and Mannitol salt agar (Fig 2), morphological characteristic like coccus arranged in grapes like bunches on Gram's staining, mannitol fermentation, catalase and coagulase positive and further characterized using specific primers for nucA gene (Fig 1). The distribution of the *S. aureus* strains among clinical samples collected from human and animals are shown in Table 1.

Table 1: Distribution of *S. aureus* among clinical samples of human and animals

S. No.	Origin	Total samples	No. of *S. aureus*
1	Human	75	46 (61.30)
2	Animal	100	32 (32.00)
3	Total	175	78 (44.57)

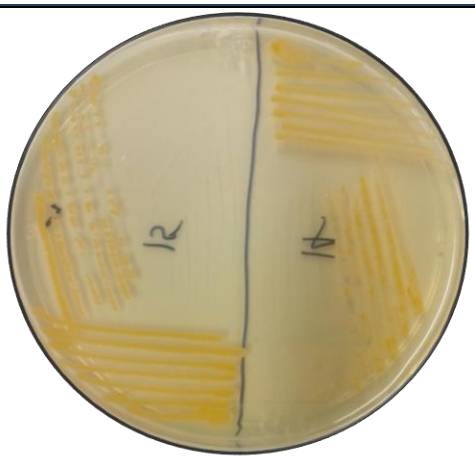

Fig. 1: Golden Yellow Colonies of *S. aureus* on Nutrient Agar

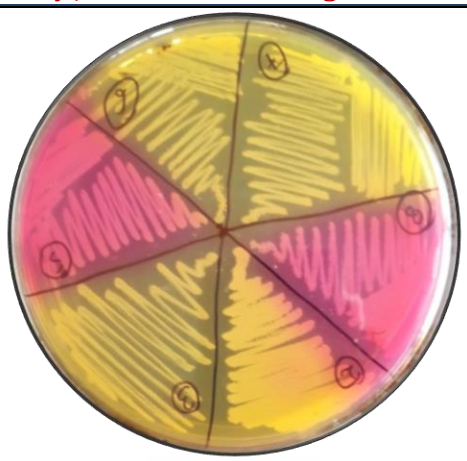

Fig. 2: Golden Yellow Colonies of *S. aureus* on Mannitol Salt Agar

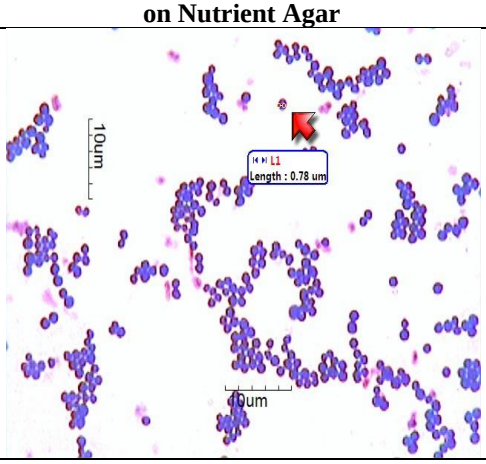

Fig. 3: Gram Positive Cocci *S. aureus* on Gram's staining

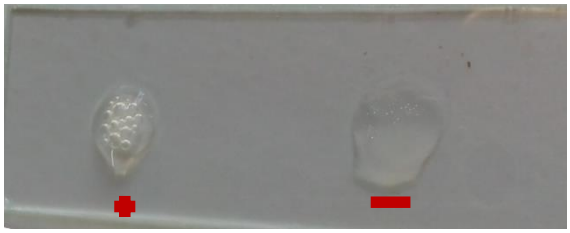

Fig. 4: *S. aureus* showing Catalase Positive Reaction

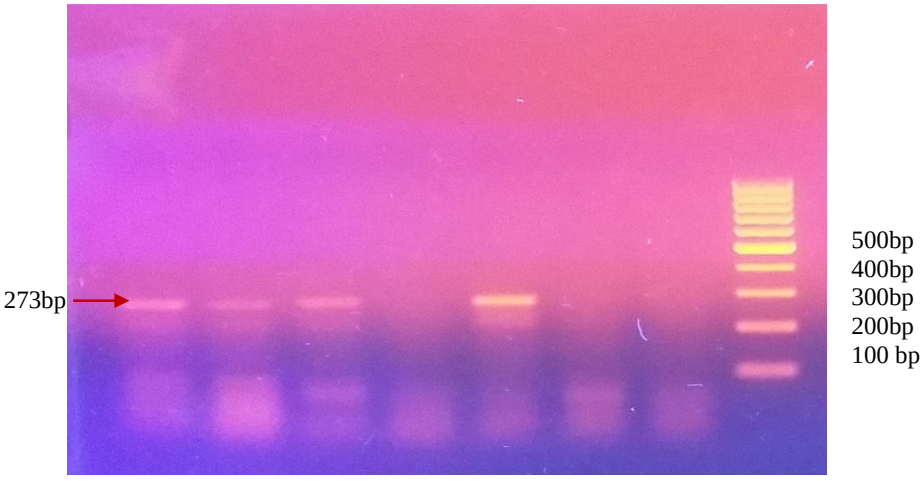

Fig. 5: PCR amplification of *Staphylococcus aureus*

Screening of biofilm production

On modified CRA, slime producing strains formed strong black colonies, whereas non-producing strains develop complete red colonies. Among all 78 S. aureus isolates, 47 (60.26%) isolates were positive in CRA, while 31 (39.74%) isolates were biofilm non-producers with red colonies. Out of 47 isolates 23 and 24 were slime producing isolates from human and animals respectively. Among these 60.2% revealed black pigmentation and 39.7% revealed red color on published Congo red agar.

Fig. 6: Congo red agar plate test. Black colonies: the slime-producing strains

Increase in the development of antimicrobial resistance in staphylococcal infections poses a serious threat to one health. *S. aureus* is a major human and animal pathogen that causes wide range of infections and due to antibiotic resistance difficult to treat. Such types of treatment failure are mainly associated with biofilms formed by *S. aureus*. Therefore, detection of biofilm forming staphylococci plays a crucial role in the prevention and management of infections. Although the prevalence of *S. aureus* infections in and around Mathura, India was previously reported [2,3,5] the prevalence of biofilm forming *S. aureus* was not studies in the area. The presence of *S. aureus* in the clinical specimen represents a potential source for the introduction of the pathogen to human and animals and resulting risk of zoonosis[11]. The present study aimed to identify the prevalence of biofilm forming *S. aureus* in various clinical samples of human and animals. In this study, 175 clinical samples of pus / wound / abscesses from human and animals were processed for isolation of *S. aureus* isolates and *in-vitro* biofilm production by congo red agar method. This study is a pilot study for detecting the prevalence of biofilm producing *S. aureus* in animals and human. Further the use of congo dye method is easy, cheap suitable and reproducible method for detection of biofilm producing Staphylococci.

Conclusion

From the study, it can be concluded that, there is high prevalence of *S. aureus* infections in wounds / abscesses in human and animals and concurrent biofilm formation. High level of biofilm forming *Staphylococcus aureus* isolates in human and animal population may play a key role in the transmission of these microorganisms.

Acknowledgement

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INDIAN DAIRY BREEDS: SOURCE OF SAFER AND HEALTHIER MILK (A2MILK)

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Abstract

Beta casein in bovine milk is abundantly present and considered as one of the excellent source of nutrition and amino acids. Beta casein chain is 209 amino acid long. If at 67th position Proline amino acid is present it will be A2 Beta casein and if histidine replaces the proline then nomenclature will be A1 Beta casein. Digestion of A1 milk results in production of a bioactive peptide known as betacasomorphine 7 (BCM7) which may lead to development of some human diseases. In A1 milk, BCM-7 level is 4 times more than in A2 milk.A1 is the most frequent in exotic breeds of cattle. Comparatively these ill effects are not seen after the consumption of A2 milk Indian native dairy cows and buffaloes have only A2 allele (A2 milk) and hence considered as source of safe milk i.e A2 milk. Although more research are needed to find out other favourable results of A2 milk. It is immediate demand of time to give attention on our cattle breeding policy for conserving and promoting valuable germ- plasm so that safe and healthy milk for public consumption can be easily available.

KEYWORDS: A2 milk, polymorphism, beta-casomorphin7, Indian native dairy cows.

Introduction

Secretions of the mammary gland of mammals after the calving results in the production of a white liquid which is most perfect food for new born of each one (including the humans) is called as milk. This milk is considered as source of complete food for the infant because of presence of carbohydrate (lactose), fat (fat soluble vitamins), proteins (proteins lipids and amino acids) and minerals in addition to water. Several micro-nutrients, enzymes, hormones, growth factors, immunoglobulins, and many bioactive peptides which are present in the milk are needed for growth and development of calf as well as for humans. The lipids in milk are emulsified and proteins are in colloidal dispersions as micelles. Milk composition varies with stage of lactation, nutrition, breed, age, health status of the udder and energy balance of the milking animal. Colostrums also differ considerably from milk to milk and the proteins are higher in colostrums than in the later lactational milk[1]. This review is focused on discussing the importance of Indian breeds of cows, and buffaloes which are confirmed as A2 milk producers and at the same time rethinking of Cross Breeding Strategies for Indian cattle breeds.

Beta- casein polymorphism and nomenclature of A1 and A2 milk:

In general Bovine milk has 85% water, 4.6% lactose (milk sugar), 3.7% triacylglycerols (milk fat), 2.8% caseins (milk protein), 0.54% minerals and 3.36% miscellaneous substances. Bovine milk protein is composed approximately of 80% casein and 20% whey. But some researchers have also opinion that whey proteins constitute about14% [2]. Beta casein is abundantly present and considered as one of the excellent source of nutrition and amino acids. The casein micelles are seen and observed as colloidal complexes of protein and salts, especially calcium[3]. This casein is of four types named as: alpha s1(CSN1S1, 39–46% of total caseins), alpha s2(CSN1S2, 8–11%), beta (CSN2, 25–35%), and kappa (CSN3, 8–15%) [4].There is also gamma-casein, which is a product of degradation of beta-casein[5].Production of Caseins are governed by polygene. The genes encoding 4 caseins are found on bovine chromosome 6 [6]. Beta-casein constitutes about 30% of the total protein content in milk. Due to polymorphism there are several variants of beta casein named as: A1, A2, A3, B, C, D, E, F, H1, H2, I, G. Out of these, common variants of beta –casein in dairy cattle breeds are A1, A2, B, A3 and C but amongst these, A1 and A2 variants are most common types of β-casein which are found in the milk of dairy cattle [7] . Beta casein chain is 209 amino acid long. Position number 67th of amino acid is deciding w.r.t. nomenclature of A1 or A2 Beta casein. If at 67th position amino acid Proline comes then it will be A2 Beta casein and if histidine replaces the proline at 67th position then nomenclature will be A1 Beta casein. A2 milk is that milk which contains only A2 type of beta-casein protein while A1 milk contains only A1 beta casein protein or A1A2 type. A1 casein protein type is generally found in milk which is produced from exotic breeds and crossbred cattle. Production of A2 casein protein milk is exclusively done by indigenous cows and buffaloes of India (Asia as a whole).

Genetics behind genotypic and phenotypic consideration of A1 and A2 milk:

The A1 or A2 milk status of a dairy cow is determined by genetic makeup on the sixth chromosome. At this locus, because of co-dominant nature of alleles (A1 and A2 beta casein alleles) there would be three possible genotypes, i.e. A1A1 (homozygous) , A1A2 (heterozygous) and A2A2 (homozygous). If homozygous combination occurs in parental generation then only one type of gametes are produced for each homozygous genotype i.e. either bearing A1 (if homozygous is A1A1) or bearing A2 (if homozygous is A2A2). In case of each homozygous condition their progeny will be having 100% probability for receiving either A1 or A2 gametes produced from respective homozygous parents. In case of A1A2 (heterozygous) individual, provided segregation is normal, there will be production of equal number of A1 and A2 gametes and their progeny will receive either A1 or A2 gametes with only 50% probability.

Distribution of Milk protein variants in different breeds of Cattle

Researches envisaged to investigate variants of milk protein on exotic cows (Taurine type), indigenous cows (Zebu type) and buffaloes have revealed that A1 allele ((A1 milk) is more frequent in exotic breeds of dairy cattle while Indian native dairy cows and buffaloes have only A2 allele[8].There are some Indian milk breeds of cows and buffaloes who are homozygous for gene (Red Sindhi, Tharparkar, Sahiwal, Rathi Gir) while some Indian breeds are around 94 per cent pure for A2 allele [9] . The percentage of purity w.r.t. purity for A2 allele decreases for foreign breeds (Jersey and HF) and it is around 60 per cent. Varient A1 β-casein is not found in the milk of pure African and Asian Cattle[10].So, our indigenous cows and buffaloes produce A2 milk.

Why A2 milk is considered as safe milk?

Digestion of A1 milk results in production of a bioactive peptide known as betacasomorphine 7 (BCM7) which may lead to development of some human diseases. BCM-7 may get absorb in the infants GIT as compared to adults. In A1 milk, BCM-7 level is 4 times more than in A2 milk. On the basis of some studies which had been carried out in the late of 20th century, it had been suggested that consumption of A1 milk increases the risk factor for type 1 (insulin-dependent) diabetes mellitus [11], ischaemic heart disease in humans [7], sudden infant death syndrome (SIDS) [12] .Some other problems like as autism and schizophrenia also seems to be associated with A1 milk consumption (higher level of BCM-7). Comparatively these ill effects are Epidemiological evidence from New Zealand suggests that A2 milk is better for human health than A1 milk [13] .As compared to the possible effects of A1 milk these ill effects are not seen after the consumption of A2 milk and hence can be considered as the safer and healthier milk.

Conclusion

Now a day due to more awareness people are more concerned with their diet and health status. Till date, results published and finding of epidemiological studies have clear indication that our indigenous dairy cattle breeds in addition to the buffalos are valuable source of producing A2 milk. Keeping the public health in mind we should see it as an opportunity to provide safe and healthy milk by our valuable dairy germ plasm. It will not only save public money but will also contribute to make healthy nation following the lines that prevention is better than treatment.At the same time the animal genetics breeders and policy makers should pay attention that - if the composition and source of bovine milk is going to decide the health status of its consumers then certainly we will have to pay immediate attention for breeding and promotion of Indian breeds of cows, and buffaloes which are confirmed as A2 milk producers and at the same time there is time for rethinking of cross breeding strategies for Indian cattle breeds.

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EFFECT OF HEAT STRESS ON NITRIC OXIDE (NO) FORMATION IN DERMAL FIBROBLAST OF MURRAH BUFFALO

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Abstract
The skin is the largest body organ that serves as protective barrier, an endocrine, sensory and thermoregulatory organ. We investigated the increased heat loads on adaptation mechanism in Murrah buffalo dermal fibroblast. Dermal fibroblasts are the most regular cell constituent of dermis in buffalo' skin that is crucial for homeostasis. Dermal fibroblasts (DF) from ear pinna of Murrah buffaloes heifers (n=10) were collected and cultured in Dulbecco's Modified Eagle Medium (DME/F-12) supplemented with 10% bovine calf serum (Hyclone, Logan, UT, USA), 1% Gentamicin solution (Sigma Chemical Co., St. Louis, Missouri, USA) at 37°C in a humidified atmosphere at 5% CO_2. After fifth passage, dermal fibroblasts was subjected to thermal stress, at 25°C, 40°C, 44°C for 3h to measure Nitric oxide (NO). The results of the study showed that overall NO production was found to be significantly different ($P<0.0001$) on exposure to different temperature. At 25°C, NO production did not differ significantly ($P<0.05$) as compared to normal temperature (37°C) in Murrah buffaloes. Due to heat stress effect, NO production increased in dermal fibroblasts cell lysate of Murrah buffaloes in comparison to control. At 40°C, NO production increased significantly ($P<0.05$). At 44°C, NO production was significantly higher ($P<0.05$) in Murrah buffaloes. In summary, dermal fibroblast resistance to heat shock differed at different temperature. Present studies revealed that an important mechanism by which cells adapt to heat stress involves modifications in endogenous NO synthesis. Nitric oxide plays a critical role in the regulation of cellular phenotypes. This specific NO signaling pathway may also operate in conjunction with gene expression. Thus, NO is a novel regulator of heat stress. Nitric oxide plays a significant role in animal survival with in sub lethal temperature.
Keywords: Dermal fibroblast, Heat stress, Murrah buffalo, Nitric oxide, Skin

Introduction

Heat stress causes significant financial burden to animal production system [1]. The increase in body temperature caused by heat stress has direct, adverse consequences on cellular function which directly and indirectly affect production of farm animals [2]. The thermal balance is affected by environmental factors (ambient temperature, relative humidity, solar radiation, air movement, and precipitation), animal factors (rate of metabolism, moisture loss) and thermoregulatory mechanisms of the animals [3]. High environmental temperature challenges the homeostasis and stimulates excessive production of free radicals [4] and excess of these free radicals causes cellular damage.

The skin being largest organ of body lead to protects the internal body structures from a hostile external environment from varied nature (pollution, temperature, humidity and radiation). Skin also help in maintaining water and heat loss from the body [5]. Skin is composed of three layers: epidermis, dermis and hypodermis. Fibroblasts are the most regular cell constituent of dermis in animals' skin [6], which represent a heterogeneous population of cells defined according to their location within the dermis. Two subpopulations of fibroblasts exist in distinct dermal layers: the papillary and reticular dermis [7]. A third group is associated with hair follicles. If animals are adapted to a set of environmental conditions, they will have skin morphological features that will allow them to survive under a given environmental condition [8]. Nitric oxide (NO) is a unique biological messenger molecule that is synthesized from L-arginine by nitric oxide synthase (NOS) enzyme [9]. NOS is a remarkably complex enzyme, which acts on molecular oxygen and arginine in neurons, endothelial cells, platelets, neutrophils and other cells to produce NO. Quantitative determination of total nitrite acts as an indicator of NOS activity in biological samples. NO is a unique second messenger molecule that readily diffuses through cell membranes to exert a variety of biological actions in mammalian cells. NO is produced and released by major cell types in skin such as fibroblasts, keratinocytes, melanocytes and endothelial cells [10, 11] and plays a significant role in the response to infection and injury in skin [12].

An important understanding on physiological role of skin will help in modulating heat tolerance and improve functions under different heat load conditions. Although dermal fibroblast cells constitute a major portion of skin, the information on fibroblasts and its response to heat stress is meager in Murrah buffalo. In light of the changing climate, an understanding of the physiological changes would allow for predictions of heat stress adaptation in Murrah buffalo. Therefore, present studies were conducted to know the effect of thermal stress on skin of Murrah buffalo.

Materials and Methods

Experimental animals

Murrah buffalo heifers (N=10) ranging from 1-2 year age group were selected from the herd of National Dairy Research Institute (NDRI), Karnal for various sets of experiments. All these animals were maintained under general management practices followed for heifers at the institute. At the time of the actual experiment, all the animals were clinically healthy and free from any physical or anatomical abnormalities.

Ethical permission

The experiment was approved by the Institutional Animal Ethics Committee (IAEC) constituted as per the article number 13 of the CPCSEA–rules, laid down by Government of India.

Isolation and Culture of Murrah buffalo dermal fibroblast

Skin biopsies were taken from the ear pinna of the healthy heifers, aseptically. The margin of the ear pinna was shaved using a razor and wiped with sterile tissue papers. Skin tissue was pinched off from the ear pinna of the animals and the wound was dressed after the application of antiseptics. Norms regarding the ethical treatment of animals during the whole operation were strictly followed. The tissue was held in sterile DPBS and transported to the laboratory for further processing. The tissues were then washed thoroughly, with Ca^{++} and Mg^{++}free DPBS. The tissue was transferred into a cell culture dish containing 2ml DMEM/F-12 supplemented with 10% FBS, 1% Gentamicin solution and 2.5µg/ml Amphotericin B. Skin along with the hair follicles was removed on both surfaces. The remaining tissue was minced into small pieces (about 1 mm in size) using a sterile surgical blade. The tissues were washed again in culture medium (DMEM containing 10% FBS), 5 times and seeded into 60 mm tissue culture dishes without addition of any medium (the small amount of medium sticking to the tissue was sufficient to nourish them till their attachment). The dishes were incubated for 4-8 hours in a CO_2 incubator and observed at different intervals so as not to allow them to dry out completely. Upon attachment of tissues, culture medium was added to the dishes and incubated in a 5% CO_2 incubator at 37ºC. Tissue explants were regularly observed for proliferation of fibroblasts and were removed aseptically when a sufficient number of

cells had proliferated and formed a monolayer on the cell culture dishes. The monolayer was treated as primary cell culture of respective cells. After reaching 70-80% confluence, the fibroblast cells were sub-cultured by partial trypsinization. The cells were subjected to 5 continuous passages for selection of homogeneous population of dermal fibroblast. The dermal fibroblast was routinely evaluated for sterility by growing them in antibiotic free media. The cells were also tested for incidence of mycoplasma contamination using Myco Alert Mycoplasma detection kit (Lonza, USA).

Heat stress to dermal fibroblast

In the present study, the dermal fibroblasts were divided into the following four groups. Group 1 (Control): carried out at 37°C. The dermal fibroblasts of the experimental groups were exposed to a temperature of 25°C (Group 2), 40°C (Group 3) and 44°C (Group 4) for 3 h.

Nitric oxide (NO) determination

Nitric oxide (NO) was determined in dermal fibroblast culture media of Murrah buffalo by "Nitrate/Nitrite Colorimetric Assay kit" (Catalog No. 780001) from Cayman Chemical Company, 1180 East Ellsworth Road Ann Arbour, MI 48108, USA.

Materials provided: Assay Buffer, Nitrate Reductase Enzyme, Nitrate Reductase Cofactors, Nitrate Standard, Griess Reagents R1 and R2.

Reagent Preparation:

Assay Buffer: The total content of the assay buffer vial was diluted to 100 ml with Milli-Q water.

Nitrate Reductase Enzyme Preparation: The vial was reconstituted with 1.2 ml assay buffer.

Nitrate Reductase Cofactors Preparation: The vial was reconstituted with 1.2 ml assay buffer.

Nitrate Standard: The vial was reconstituted with 1.0 ml assay buffer. Again 0.1 ml of reconstituted Nitrate Standard +0.9 ml of assay buffer yielded 200µM concentration that is used to prepare 0, 5, 10, 15, 20, 25, 30 and 35 µM concentration.

Assay Protocol: (1) 200 µl of assay buffer was added to the blank wells. Any other reagent was not added to blank wells. (2) 80 µl of sample and standards were added to the ample and standard wells. (3) 10 µl of the enzyme cofactor mixture was added to each standard and sample well. (4) 10 µl of the nitrate reductase enzyme mixture was added to each standard and sample well. (5) Plate was covered with adhesive strip and incubated at room temperature for one hour. (6) 50 µl each of Griess reagents R1 and R2 was added to each standard and sample well. (7) Optical density was taken after 10 minutes, using TECAN infinite PRO200 ELISA reader (Tecan Asia Pte Ltd. Singapore) at 540 nm.

Calculation: The duplicate readings were averaged for each standard and samples. The average blank optical density was subtracted. The average absorbance of standards as a function of final nitric oxide concentration (µM) was plotted and concentration of the samples were calculated using linear regression equation of standard curve.

Precision: Inter-assay and intra-assay coefficient of variation was 3.4% and 2.7% respectively.

Assay Range: 2.5–200 µM

Statistical analysis

The data analysis was done using SAS software, Version (9.1) of the SAS System for Window, Copyright© (2011) SAS Institute Inc., Cary, NC, USA. Data from different experiments are presented as mean±SE. The pair-wise comparison of means was carried out using Tukey's multiple comparison tests. The difference at P≤0.05 was considered to be statistically significant.

Results and Discussion

Nitric oxide production is an indicator of cellular stress. The results on nitric oxide (NO) have been presented in table 1.0; change in NO at different temperatures has been shown in figure 1.0.

At normal temperature (37°C) for optimal cell growth, total NO production observed was 9.59±0.24µM. Exposure at 25°C resulted in to a decrease in NO production but the level increased at 40 and 44°C (table 1.0). Decrease in NO production at 25°C was observed to be 8.07±0.20 which is 15.88 % less than normal value at 37°C (figure 1.0). The NO production increased by 12.2±0.59 which is 27.36 % more at 40°C, whereas value increased further to 14.18±0.46 which is 47.85 % more at 44°C exposure temperature as compared to normal value at 37°C (figure 1.0).

Table 1.0 Effect of heat stress on NO production (µM) in dermal fibroblasts of Murrah Buffalo (N=10; Mean±SE)

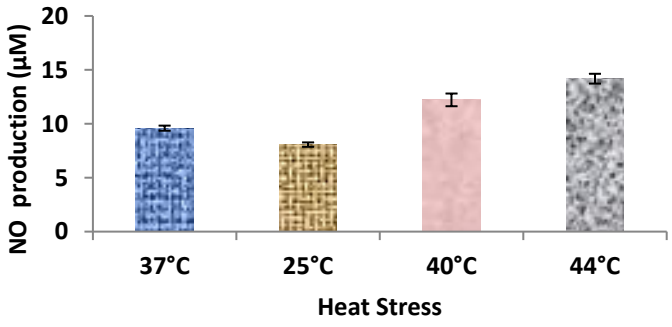
Group	Temperature (°C)	NO production (µM)
Group 1	**37**	9.59±0.24[a]
Group 2	**25**	8.07±0.20[a]
Group 3	**40**	12.22±0.589[b]
Group 4	**44**	14.18±0.46[c]

Mean ± SE with different superscript in small letter in the column differ significantly (P<0.05)

The overall NO production was found to be significantly different (P<0.0001) on exposure to different temperature. At 25°C, NO production did not differ significantly (P<0.05) as compared to normal temperature (37°C) in Murrah buffaloes. Due to heat stress effect, NO production increased in dermal fibroblasts cell lysate of Murrah buffaloes in comparison to control. At 40°C, NO production increased significantly (P<0.05). At 44°C, NO production was significantly higher (P<0.05) in Murrah buffaloes.

The present studies on dermal fibroblasts of Murrah buffaloes indicated that NO production decreased at 25°C, whereas increased at 40 and 44°C as compared to control temperature (37°C). The increase in stress markers and the deviation from normal cellular functions reflects increased level of stress. The increased levels of the NO are associated with the susceptibility of dermal fibroblasts to different environmental stress. The higher level of NO in Murrah buffaloes confers their susceptibility to hot dry environment.

Figure 1.0 Effect of heat stress on percentage (%) change in NO production (µM) in dermal fibroblasts of Murrah Buffalo



The primary source of ROS is molecular oxygen (O_2) and in aerobic cells during electron transport, about 10% of reducing equivalents from NADH leaks to produce superoxide (O_2^-) and hydrogen peroxide (H_2O_2). RNS (NO) also fuel ROS generation through a similar interaction with cytochrome *c* oxidase to give rise to O_2^-/H_2O_2 or react with O_2^- to generate peroxynitrite ($ONOO^-$). ROS attacks DNA to form hydroperoxides and peroxides [13, 14]. Mitochondrial nitric oxide synthase produces NO, the primary RNS that reacts with O_2^- to give peroxynitrite. In normal cellular metabolism, low to moderate ROS/RNS are generated as part of the signaling pathways, and in innate and adaptive immune response against danger signals [15]. The production of NO is associated with the inflammatory process. It was significantly affected by heat stress, suggesting that the

up regulation of iNOS in this study might be associated with NO production after cyclic heat stress [16].

NO is also involved in skin cell growth and differentiation. The half-life of NO is 3-5 sec in biological tissues and it acts only locally [17]. It is degraded to stable end products nitrate and nitrite by reacting with oxygen and water [18]. It has the capacity to modulate the activity of proteins through reversible reactions with available functional groups, notably ferrous and thiols. Thus, enzymes such as guanylylcyclase, cyclooxygenase and cytochrome P450 become target for nitric oxide. NO mediates a variety of essential physiological functions viz. vasodilation, mediation of immune defense, neurotransmission, cytoxicity and inflammation [19]. Pathophysiological functions include interaction with mitochondrial systems to regulate cell respiration or cell death [20]. A co regulated function between iNOS and HSP70, both in normal and in oxidative stress conditions have been demonstrated [21, 22]. NO displays anti-inflammatory and antimicrobial properties and plays a significant role in wound healing [23, 24, 25, 26] and infection [27]. The biphasic action of NO and its metabolites on cell proliferation of keratinocyte has been studied. Some co-workers also reported that NO increases intracellular cGMP level, and cGMP signaling pathway is involved in collagen expression in response to NO [28, 29]. Buffalo lymphocytes are responsive to nitric oxide compounds and produce significant amounts of nitric oxide to modify lymphocyte mitogenesis [30]. Buffalo lymphocytes produce NO, which was significantly enhanced in response to mitogen stimulation during gestation and peripartum period [31]. Though the production was more during 2nd and 3rd trimester or on day of parturition, the difference was not significant owing to significant variations between lymphocyte activities in different buffaloes [32]. High THI or milk production level of buffaloes does not significantly affect nitrite production by PBMCs in vitro, though PBMCs of high producing buffaloes and those in hot season showed higher nitrite in their culture supernatants [33]. The Murrah buffalo calves lymphocytes also have an active nitric oxide synthase (NOS) system [34].

NO plays a key role in orchestrating the skin's response to external stimuli such as heat, ultra violet (UV) light, response to infection, and wound healing, as well as possibly underlying certain pathological conditions [35]. The human skin represents a tissue with demonstrated roles for NO generation by constitutively expressed NOS in whole-body thermoregulatory reflexes and in local control of skin vessels [36]. Only inflammatory processes, such as skin burns or wounds, increase iNOS levels to those of nNOS and eNOS [37]. In addition, 24 h or longer are required for sufficient expression of iNOS to generate increases in NO levels [38]. These observations argue against a role for iNOS in cutaneous active vasodilatation.

Present research indicated that an important mechanism by which cells adapt to heat stress involves modifications in endogenous nitric oxide (NO) synthesis. The effect of oxygen on the NO pathway involving cyclic guanosine monophosphate (cGMP)-dependent signaling appears to play a critical role in the regulation of cellular phenotypes. This specific NO signalling pathway may also operate in conjunction with gene expression. Thus, NO is emerging as a novel regulator of hat stress in Murrah buffalo.

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PREVALENCE OF BIOFILM FORMING *STAPHYLOCOCCUS AUREUS* IN CLINICAL SPECIMEN FROM HUMAN AND ANIMALS

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Abstract

Staphylococcus aureus is considered as a potential cause of wide variety of infections in human and animals. Biofilm formation not only protects the bacteria from host immune cells but also protect it from antimicrobial drugs thus facilitating the survival of bacteria for a longer period. The aim of this study was to determine the prevalence of biofilm formation among *S. aureus* isolated from clinical samples of human and animals in and around Mathura, India. In the present study, a total of 175 clinical samples from human (75) and animals (100) were collected and processed for isolation of *S. aureus*. All the *S. aureus* isolated were further confirmed by morphological, standard biochemical tests, and molecular tests. Biofilm formation ability of *S. aureus* isolates were examined by Congo red agar (CRA). A total of 175 samples were collected from animals and human, out of them, 78 (44.57%) samples were confirmed as *S. aureus* on the basis of cultural, morphological, biochemical and molecular characteristics. All the 78 isolates were tested for slime production using congo red agar method and only 47 (23 from human and 24 from animals) were found positive for biofilm formation. From the study, it can be concluded that, there is high prevalence of *S. aureus* infections in wounds / abscesses in human and animals and concurrent biofilm formation. High level of biofilm forming *Staphylococcus aureus* isolates in human and animal population may play a key role in the transmission of these microorganisms.

Keywords: Biofilm formation, Congo red dye, Prevalence, *Staphylococcus aureus*

Introduction

Staphylococcus aureus is a leading cause of infections in human as well as animals [1-3]. It may cause variety of infections ranging from minor skin infections to chronic systemic infections and sometimes failures of treatment [4]. This ability of bacterium is mainly due to the acquisition of resistance to multiple antimicrobials, virulence and capability to produce biofilms [5-7]. Biofilms are the extracellular polymeric substances, which provide the protection from host immune defense and space for the growth of bacterial, thus facilitating the survival of bacteria for a longer period. Infection due to biofilm producing *S. aureus* is more dangerous in comparison to that of non–biofilm producing *S. aureus* because bacteria within the biofilm are also protected from the antimicrobial agents leading to failure of treatment and repeated infections [8].

In a resource-limited country like India, the prevalence and early detection of biofilm forming *S. aureus* in clinical isolates is essential for the prevention and management of infections in humans and animals. Although previous studies have demonstrated the prevalence of *S. aureus* [2,3,5], limited knowledge about prevalence of biofilm forming *S. aureus* is available in clinical samples, especially in human and animal's infections. In the present study, authors aim to detect the prevalence of biofilm forming *S. aureus* in clinical isolates of man and animals in medical and veterinary practices in and around Mathura, India.

Materials and Methods

2.1. Sample source and collection

A total of 175 samples were collected during the study, out of them 75 samples were from humans consisting of pus samples from wounds, post-operative wounds, skin abscess, while 100 samples from animals from different sources such as abscesses, post-operative wounds, wounds etc. from the cattle, buffalo and dogs presented to the Veterinary Clinical Complex (VCC), DUVASU, nearby Goushalas and during clinical camps in and around Mathura, India. All the pus samples were collected with the help of sterilized swabs and immediately transferred to Tryptose soya broth (Hi Media, India) with 6.5% NaCl (Merck, India) for further processing.

2.2. Isolation and identification of *S. aureus*

All the samples were cultured on Nutrient agar media (Himedia, India) containing 6.5% Sodium Chloride. The presumptive Staphylococcus colonies (golden, round, smooth, glistening, opaque) were subjected to Gram's staining, biochemical tests, including mannitol fermentation, positive catalase and negative oxidase reaction [9].

2.3 DNA Extraction and PCR assay:

The DNA of all isolates was extracted using the phenol chloroform method as described previously (Sambrook and Russel, 2001). Concentration of DNA in each extract was measured using Nanodrop 1000 (NanoDrop). PCR primers for nucA gene and conditions of PCR have been described previously [10].

2.4. Screening of biofilm production:

The *in vitro* biofilm production was measured using phenotypic assays like Congo Red Agar (CRA) method. The biofilm producing strains were screened by qualitative methods like Congo Red Agar (CRA) method. All the confirmed *S. aureus* were grown on Congo red agar plates for 24h at 37°C and analyzed as described previously [11]. Black and brown colonies were regarded as slime producer isolates, while red and dark red colonies classified as non-biofilm producing strains.

Results and Discussion

Out of 175 clinical samples of wounds/ abscesses collected from human (75) and animals (100), 78 (44.57%) were positive for *S. aureus*. The prevalence of *S. aureus* in human and animal samples separately was found 61.3% and 32% respectively. All the 78 *S. aureus* isolated strains were showing cultural characteristics producing golden yellow colour colonies on Nutrient agar medium (Fig 1) and Mannitol salt agar (Fig 2), morphological characteristic like coccus arranged in grapes like bunches on Gram's staining, mannitol fermentation, catalase and coagulase positive and further characterized using specific primers for nucA gene (Fig 1). The distribution of the *S. aureus* strains among clinical samples collected from human and animals are shown in Table 1.

Table 1: Distribution of *S. aureus* among clinical samples of human and animals

S. No.	Origin	Total samples	No. of *S. aureus*
1	Human	75	46 (61.30)
2	Animal	100	32 (32.00)
3	Total	175	78 (44.57)

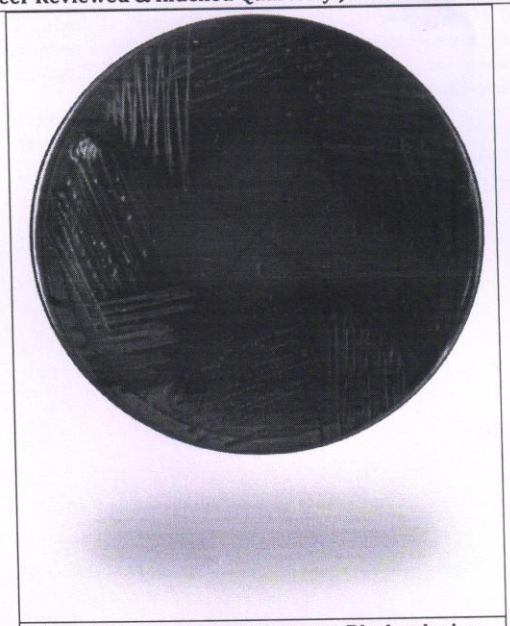

Fig. 6: Congo red agar plate test. Black colonies: the slime-producing strains

Increase in the development of antimicrobial resistance in staphylococcal infections poses a serious threat to one health. *S. aureus* is a major human and animal pathogen that causes wide range of infections and due to antibiotic resistance difficult to treat. Such types of treatment failure are mainly associated with biofilms formed by *S. aureus*. Therefore, detection of biofilm forming staphylococci plays a crucial role in the prevention and management of infections. Although the prevalence of *S. aureus* infections in and around Mathura, India was previously reported [2,3,5] the prevalence of biofilm forming *S. aureus* was not studies in the area. The presence of *S. aureus* in the clinical specimen represents a potential source for the introduction of the pathogen to human and animals and resulting risk of zoonosis[11]. The present study aimed to identify the prevalence of biofilm forming *S. aureus* in various clinical samples of human and animals. In this study, 175 clinical samples of pus / wound / abscesses from human and animals were processed for isolation of *S. aureus* isolates and *in-vitro* biofilm production by congo red agar method. This study is a pilot study for detecting the prevalence of biofilm producing *S. aureus* in animals and human. Further the use of congo dye method is easy, cheap suitable and reproducible method for detection of biofilm producing Staphylococci.

Conclusion

From the study, it can be concluded that, there is high prevalence of *S. aureus* infections in wounds / abscesses in human and animals and concurrent biofilm formation. High level of biofilm forming *Staphylococcus aureus* isolates in human and animal population may play a key role in the transmission of these microorganisms.

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ROLE OF HORTICULTURE IN FOOD AND NUTRITIONAL SECURITY IN INDIA

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Horticulture in India

India support more than 17 % of the population with only 2.4 % land share. At the global level, it appears that we are slowly moving towards global food crisis. Recently published special report of UN on the ¯Right to Food? estimated that nearly one billion people sleep without food across the world, and among every six seconds a child dies of malnutrition. Agricultural production is an important contributor to India economy and providing nearly 67% of the country's employment. Over the past few years, horticulture has made remarkable progress in terms of expansion in area and production under different crops, increase in productivity, crop diversification, technological interventions for production and post-harvest and forward linkages through value addition and marketing. Despite several challenges and opportunities namely tumultuous weather, seasonal cyclones, occasional drought, demographic pressure, industrialization, urbanization and unprecedented use of insecticide & pesticide and compulsion for migration of rural masses to urban areas, especially for their livelihood. Horticulture is not merely a means of diversification but forms an integral part of food, nutritional security and poverty alleviation, and also an essential ingredient of economic security. India, like many other countries, is very concerned about food security, thus rural development has become primary area of focus in the current agricultural and horticultural development programs.

India with diverse soil and climate comprising several agro ecological regions gives encouragement to horticulture crops. India with more than 28.2 million tonnes of fruits and 66.0 million tons of vegetable production ranked next after Brazil and China in the World. Occupying 10% cropped area out of whole cropped area by horticulture ranked 2nd in the world for fruit and vegetable production. The share of India in the world production is 10% and vegetable for 13.28%. Contribution of horticulture to GDP of agriculture is estimated to be more than 24.5%. Horticulture sector established in improving productivity of land generating employment, improving economic conditions, enhancing export and provide nutrition security to the people. Food security, which is the main object on the national agenda and this, can be attain with providing nutritional and balance diet to population. Recommendation dietary allowance as per ICMR is 120 g fruits and 300 g vegetable per person per day. The availability is only 83 g and 185 g of fruits and vegetable respectively which is below the target level.

Horticulture: Why it is best option?

Horticulture has wider adaptability and provides wider choice to farmers, for growing wide range of crops in different environments, soil and climate conditions. Horticultural crops, can be grown even in marginal and degraded soils, and has enriched the farmers having degraded land by having choice of crops and practices. There are many horticultural crops which are complementary as food, i.e. potato, tuber crops and banana and vegetables. Fruits and vegetable therapy is now a practice to have good health without medication and many crops are used as herbal medicine. New paradigm, therefore, has to be horticulture based farming system for greening, environmental service and to provide nutritious food and enhanced farm profitability.

Horticulture for health care

Health care of people, at large, has been through modern medicine but still in Asia more than 80 percent people depend on herbs. Many of doctors now feel that modern medicine brings illness rather than wellness, and subscribe for balanced diet which protect against many disease by enhancing self protective mechanism through many immunological advantages. The fruits (aonla, bael, jamun, papaya), vegetables (carrot, cauliflower, onion, garlic, leafy vegetables), spices (ginger, turmeric, black pepper, fenugreek, ajowan) and ornamental plants (Ashoka, Ficus, catharanthus) protects against various kind of diseases. The spices like turmeric, chillies and cuminin the diet have been recognized to protect against cancer. Noni (Morinda citrifolia) with unique characteristics is recognized as best for health care, as it provides protection against various diseases including HIV. Virgin coconut oil protects from HIV and coconut water provides all nutrients to child apparently. Horticultural crops thus provide ample opportunities for health care. According to the Food and Nutrition Board of the National Research Council, man and women between 23 and 50 years eat about 2800 and 2,200 calories a day, respectively to maintain weight. The nutrient needs are liable to vary with gender, age, height, weight, physical condition, activity level and the climatic conditions where they live. Pregnant women and lactating

mothers will need additional 300-500 calories per day than their usual needs. Thus, fruits and vegetable provide wider option for meeting the energy requirement for the human system Cereals are the main staple food which lacks in various mineral and vitamins but to sustain and lead a healthy life, the food we eat should contain a wide range of nutrients in proper proportion i.e. it should be a well balanced diet. The nutrients include proteins, fat, carbohydrates, vitamins, fibre and minerals. Each nutrient has a definite function. No single fruit or vegetable can nourish the body with all the vital ingredients it requires. Hence it is important to consume a variety of fruits, vegetables, spices and condiments to derive required nutrition. Horticultural crops are meeting essential requirement for which these crops are rich source of energy, proteins, vitamins, minerals and antioxidants etc. for nourishment of our body.

Scenario of horticulture and human nutrition

Fruits and vegetables are also rich source of vitamins, minerals, proteins, and carbohydrates etc. which are essential in human nutrition. Hence, these are referred to as protective foods and assume great importance as nutritional security of the people. Thus, cultivation of horticultural crops plays a vital role in the prosperity of a nation and is directly linked with the health and happiness of the people. The emphasis on horticulture is recognition of the need for attaining nutrition security and for a sustainable income. Healthier diets will improve the learning capacity of children and the working capacity of adults, leading to higher incomes and a reduction in poverty.

In human nutrition, fruits and vegetables play an important role towards the making of a balanced diet. To some extent, they provide energy rich food. Banana, jackfruit, annona, sapota and fig contain carbohydrates in the range 19 to 24 percent and are good sources of energy comparable to potato, colocasia, tender maize, yam and green peas (15.9 to 24.6 per cent carbohydrates and 79 to 125 k cal energy). Closely following this group of fruits as good sources of energy are mango, litchi, grapes, ber pomegranate, phalsa and jamun. Fresh avocado is the only highest energy yielding fresh fruit yielding 161 to 215 kcal per 100 g of edible portion due to its high fat content (15-26%). But, fruit and vegetables are indispensable as sources of vitamins and minerals, which help in building resistance against diseases. Fruits and vegetables furnish 90% of the vitamin C and 60% vitamin A in the world. Mango and papaya are rich in pro-vitamin A and guava in vitamin C, Banana, among fruits is a good source of carbohydrate.

Horticultural crops in general are poor sources of protein as they contain less than 2% protein. Fruits are a rich source of organic acids like citric acid in citrus fruits and tartaric acid in grapes, which stimulate appetite and helping digestion. Papaya contains protein digesting enzymes. Many fruits and vegetables possess laxative property due to the presence of dietary fibre and pectin, which stimulate intestinal activity. Due to poverty, micronutrient malnutrition, is posing a threat to vulnerable sections in Asia and the Pacific regions. This is manifested in the form of vitamin A deficiency, iron deficiency anaemia and iodine deficiency disorders. The first two could be minimized, as discussed earlier, through horticulture intervention and awareness drive.

Ensuring food and nutrition

Food security is thus a challenge for India. A transmission from underdeveloped to developing economy, India yet dominating by agriculture sector instead there must be industrial or service sector as a dominant to economy. Since last 60 years India has been emphasizing on rapid and key industrialization with the force of implementing five year plan strategy, yet agriculture sector plays vital role in economy. That's why the agriculture sector considers as a spinal cord of economy. The share of agriculture has been falling from since yesteryears and industrial and service sector have been on a rising constantly.

Agriculture sector is not only the biggest sector in the economy but also the most private sector too. This is one of the biggest unorganized sectors in any other sectors of economy. Today, food security concerns include not only the problems of physical availability of food stocks as well as economic and physical access to food stocks, but also biological utilisation of food consumed. That is, environmental conditions such as availability or otherwise of safe drinking water and sanitation as well as nutrition practices and knowledge that can help or hinder the absorption of food into the body form part of the more inclusive contemporary conception of food security.

Agriculture and Government Strategy

For developing this dominant sector government of India has initiated various ideas from the independence era. In planning era-commenced form 1951 for acceleration development in economy, vital importance gave to agriculture sector beside with industrial sector. Government in direction to improve agriculture sector, implemented various

schemes like as improvement in agriculture productivity, modernization of agriculture and inclusive growth in rural sector. Establishment of new credit structure for rural and agriculture finance and framed laws for stability in agriculture production brought into force for successive implementation of schemes and planning strategy. Beside this government undertook numerous programs for increase agriculture production and rural employment e.g. irrigation facilities, fertilizers and pesticides inputs, agriculture machinery etc. Though the government emphatically brought increase in agriculture sector, increase in population creates heavy burden on agriculture sector. To lessen this excessive burden on agriculture sector government encourages to setting up agro-based projects besides prime occupation farming. For this prime object government extended the all possible assistance to promoting agro based projects with finance, technical know- how, basic infrastructure etc. the cooperative sector in economy stands with government shoulder to shoulder to give shape to agro based projects. With all agro based projects shaped in economy with the help of government these is Horticulture projects setting its unique importance in present era.

Production needed to achieve nutritional security

Vegetables and fruits appear to be playing a prominent role in prevention of several chronic diseases such as heart disease, cancer, cataract, osteoporosis, diabetes, etc. The active constituents responsible for this property have been shown to be a number of nutrients, phyto-chemicals and fibre. Apart from micronutrient related function, the bioactive phyto-chemicals prevent degenerative processes by antioxidant activity. In order to have protective effect, it is necessary to consume 400- 600 g of fruits and vegetables every day. But, the consumption level of fruits is low and widely variable from region to region in India. Fruit consumption level is as low as 1 g/day/person in the states of Manipur and Nagaland to 70 g/day/person in the Union territory of Chandigarh. An increase in the intake of fruits along with vegetables will meet the required daily allowance (RDA) of many nutrients. India with more than 75.22 million tonnes of fruits and 141 million tonnes of vegetables is the second largest producer of fruits and vegetables in the world next only to Brazil and China. However, per capita consumption of fruits and vegetables in India is only around 46 kg and 130 g against a minimum of about 92 g and 300 g respectively recommended by Indian Council of Medical Research and National Institute of Nutrition, Hyderabad. With the present level of population, the annual requirement of horticulture produce will be 345 million tonnes by 2016-17 as against the present level of production 234.5 million tons during 2010-11.

Challenges ahead in food production

The growing population is the major concern and is the big challenge for meeting the food needs worldwide. According to one of the predictions from FAO, the agricultural productivity in the world will sustain the growing population in 2030, but millions of people in developing countries will starve for food nutrition and remain hungry due to shortage. By 2025, 83% of the expected global population of 8.5 billion will be in the developing world. The question before us is - can we meet food needs and provide nutrition, health care, fuel and fiber to growing population? The answer is – 'it is difficult, but not impossible. Past experiences build the confidence, that, country has achieved. It was difficult to feed 320 million populations and now we are able to feed 1011 million people and have surplus too beside appreciate growth in horticultural and livestock. Crops which were not grown at particular location are made to grow. Indian Agriculture, even with high pressure on land (17% population from 2.3% land and 4.5% water) has fed the Indian population. In the post- independence period, India made a steady progress in agriculture. Agriculture was simple, extra land and water was available, few genes did wonder that ushered in 'Green Revolution'. But the challenges before us now are much greater than before.

In the prevailing circumstances of shrinking farming land, depleting water resources and changing climate, the situation has become complex. Optimistically, through the inputs of science and technology, challenges ahead could be converted into opportunities for sustainable production. Horticulture has proved to be the best mean of diversification for higher land productivity has been achieved with context to gross return per hectare. But there is need to make the sustainable development in production of fruits, vegetables, tubers, plantations and tuber crops for meeting the growing demand of rising population with nutritionally rich horticulture produce.

CONCLUSION

Indian agriculture is generally marked with a low profit. Further, the farm income generated is not sufficient to provide a livelihood (Chand et al 2011). In this context, to double farmers' income, diversification towards high value

horticultural crops is a major strategy. Aggregate data indicates that the area of the horticultural crops is on an increase both at the level and as a share of gross cropped area. The share of high value crops in the total value of output is also on an increase. Of the growth of the value of output from entire agricultural and allied sectors, about one third is by horticultural crops. Increasing income trends has made market for horticultural commodities more widespread and profitable. These high value and nutrition rich commodities are substituting majorly cereals and other food grains with higher value productivity, resulting in higher income to farmers. The trend analysis has shown wide variation in the growth performance of fruits and vegetables across states. Generally, the productivity growth at all India level is low, which needs to be addressed. The major strategy towards this is by improving the total factor productivity growth, through research and development (Suresh and Mathur 2016). Both public and private sector bears significant role in it. Considering the dominant role of small holders in horticultural production, the public sector research needs to be strengthened to produce improved technology and management practices. The export of the horticultural products are mainly as fresh produce or products with low processing, which leads to lower value realisation. Urgent steps are needed to promote value addition and for entrepreneurship development in processing of horticultural products. The export market requires adherence to prescribed quality norms, for which care needed to be taken in all nodes across the value chain. The current base of the export destination need to be widened, so as to reduce the price volatility, spread risk and expands export volume. The key instrument in development of the horticultural sector would be location specific research and development programmes, development of infrastructure in terms of cold storage, marketing yards and rural roads; and deepening and widening processing facilities.

Research and Development

4_2019

Evaluation of storage stability of soy flour and chicken meat blend noodles at room temperature

By Akhilesh K. Verma, V. Pathak, P. Umawaw and V.P. Singh

The aim of the present study is to investigate the storage stability of developed chicken meat noodles at room temperature for one month. Chicken meat noodles were prepared with the incorporation of minced chicken meat (T = 50%) and control (C = 0%) in the product formulation. The prepared chicken meat noodles were examined for various physico-chemical parameters, free fatty acid (FFA), thiobarbituric acid reacting substances (TBARS), water absorption index (WAI), water solubility index (WSI), textural indices, microbial quality and sensory attributes of the noodles at ten days of gap up to one month of storage study. Moisture content, water activity (a_w), TBARS, FFA, water absorption index (WAI), crispiness, standard plate count (SPC), yeast and mould counts were increased considerably ($P<0.05$) during storage. Whereas, fat, pH, hardness, work of shearing and sensory quality decreased significantly ($P<0.05$) throughout storage. Though, microbial growth, TBARS, FFA values, and sensory quality were under acceptable limits during the storage study. Results can be concluded that the chicken meat (50%) incorporated soy flour noodles can be stored in aerobically packaged condition at room temperature for one month with slight changes in its physico-chemical, lipid oxidation, microbial quality, and sensory attributes.

KEYWORDS

- Meat noodles
- Nutritional
- Microbial quality
- Lipid oxidation
- Texture profile
- Sensory evaluation

Today's noodles become more popular in the world due to the presence of some interesting feature such as unique taste, easy preparation, and longer shelf-life and affordable price based on changing food habits of children and teenagers which created a good market for noodles globally. As per a WINA report (2015) noodle manufacturers supplied 97.7 bn. servings and the worldwide demands are on the rise. Generally, noodles are prepared with cereals, which are rich in carbohydrates, deficient in proteins, vitamins, dietary fibre and other essential nutrients.

Therefore, the demand for foods enriched with proteins from animal and plant sources has been increasing among health-conscious consumers. Thus fulfill the demand of the consumer; soy which contains about 40% protein is rich in lysine while meat protein is rich in essential amino acids, fatty acids, some micronutrients, and also enhance the palatability of noodles. The addition of chicken meat in a noodle formulation overcomes this deficit of the cereals and can enhance the demand and functionality of noodles (Verma et al., 2015) (Fig. 1). Ahmed et al. (2011) and Verma et al. (2013) also reported that soy foods have beneficial effects in reducing risks of coronary heart disease and may reduce risks for some cancers. Hence, for the preparation of noodles using a mixture of these two ingredients in appropriate amounts with other ingredients may help to fulfill the requirements.

Therefore, a lot of studies have been carried out by various researches for improving the overall quality, palatability, high biological value and enhance the storage stability of noodles. Incorporation of chicken meat (Khare et al., 2014; Verma et al., 2015), fish protein concentrate (Sidwell et al., 1970), and noodle enriched with whey protein concentrate and skim milk powder (Baskaran et al. 2011) and the incorporation of surimi powder by Chin et al. (2011) were studied. Therefore the present objective was taken for the evaluation of changes in the quality of developed soy-flour based chicken meat noodles during storage at ambient temperature up to 30 days at a 10 days interval.

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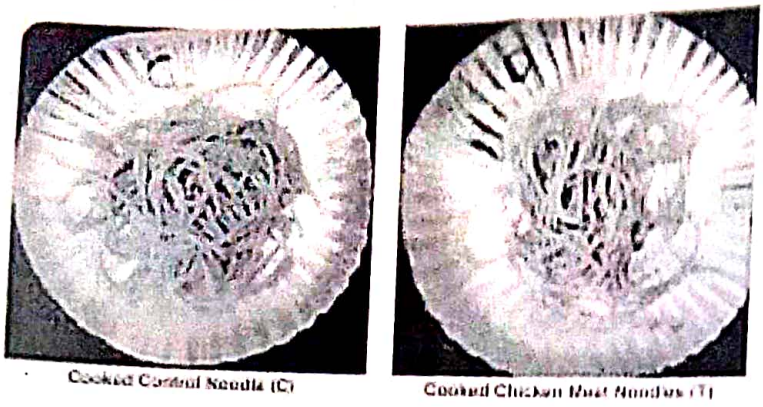
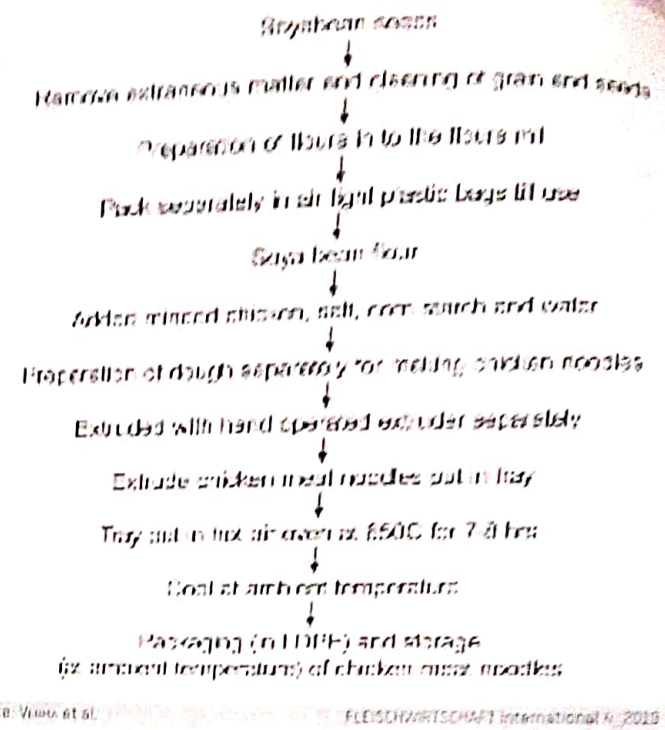


Cooked Control Noodle (C) Cooked Chicken Meat Noodles (T)

Fig. 1: Comparison of control (C) vs. chicken enriched test noodles (T)



Source: Yadav et al. FLEISCHWIRTSCHAFT International 4/2019

Fig. 2: Flow diagram for the preparation of chicken meat noodles

Material and Methods

The broiler chickens were purchased from poultry farm of Duvasu, Mathura, India. A scientific procedure was followed during slaughtering in the experimental slaughterhouse of the Department of Livestock Products Technology. Loose connective tissues and fascia were removed from the dressed carcass. The deboned broiler meat was packed in low-density polyethylene bags and then frozen at –18±1 °C till use. Frozen meat chunks were removed and cut into smaller cubes after partial thawing in refrigeration. Smaller chunks of meat were then minced twice using 6 and 4 mm grinder plates to obtain finely minced chicken meat. Good quality soybeans were purchased from the local market and dried in a hot air oven at 65 °C for 7 to 8 h. After the completion of drying the soybeans were finely ground in a flour mill to obtained fine quality soy flour. All the chemicals and reagents used in this study were of analytical grade and purchased from reputed firms.

Preparation of chicken meat noodles

Soy flour, minced broiler meat and the other constituents (Tab. 1) were kneaded well for preparing the batter. Control noodles (C) without chicken meat whereas test noodles with 50% chicken meat (T) were prepared. The prepared batter was extruded in a tray through a manually operated extruder getting their rounded shape. For drying of the prepared noodles the trays were kept in a hot air oven (SciTech) at 65±2 °C for 7–8 h (Fig. 2). Before packing the dehydrated and cooled noodles were manually broken into approximately 10–15 cm long pieces, which were then packed in pre-sterilised LDPE pouches and kept at room temperature for the further investigation.

Preparation of taste maker for sensory evaluation

All ingredients were used for the preparation of taste maker procured from local market of Mathura, Utter Pradesh, and India. After removal of extraneous materials from the raw ingredients were oven dried at 55 ± 20 C° for 3 h. While the onion, garlic, ginger, and raw carrot were peeled off manually and then cut into the small pieces for suitable to drying in the microwave LG at low frequency for 2.5 min, one side then turns it and further kept for 2.5 min again at the same frequency. After they were taken out from micro oven and were kept into the hot air oven at 60 ± 50 °C for sufficient time such that they may be easily pulverized. The ingredients were ground mechanically in Inalsa food mixer and sieved through a fine (U.S.S. #30) mesh screen. The powders so obtained were mixed in suitable proportion to obtain a taste maker for chicken meat noodles (Tab. 2). The taste maker was then immediately packed in presterilized LDPE bags (low-density polyethylene) for subsequent use.

Analytical techniques

The moisture, protein, fat and ash contents of the samples were estimated using standard methods described by AOAC (1995). The cured fiber content was determined as per the method of Saura-Calixto et al. (1984)

The pH value of the batter and the prepared chicken meat noodles were measured as per the method described by Trout et al. (1992). The lipid oxidation parameters were determined by using the TBARS test as per Witte et al. (1970) with suitable alterations. The TBARS value was presented as mg malonaldehyde per kg of the sample by multiplying with K factor 5.2. The free fatty acid (FFA) value was determined by the method described by Koniecko (1979). The water activity (a_w) value was estimated using a hand-held portable digital water activity meter (Aqua Lab, USA). Te water absorption index and water solubility index was estimated in accordance with the method described by Anderson et al. (1969).

Texture profile analysis (TPA)

The textural profiles of the prepared noodles were estimated using the texturometer (stable microsystem TA XT-2i/25) at the Goat Products Technology Lab at the Central Institute for Research on Goats (CIRG)

Tab. 1: Formulation used to prepare the chicken meat noodles

Ingredients (%)	Control	Treatment
Minced chicken meat	0.00	45.00
Table Salt	2.00	2.00
Soya flour	90.00	45.00
Starch corn	8.00	8.00
Total	100.00	100.00
Water requirement	40.00	35.00
Cooking time (min)	12.25	10.25

Source: Yadav

Tab. 2: Composition of taste maker

Name of ingredients	Percentage (w/w)
Aniseed (Soanf)	4.00
Black pepper (Kalimirch)	2.00
Turmeric powder	1.00
Capsicum (Mirch powder)	3.00
Nutmeg (jaiphal)	0.200
Cardamom dry (Chhoti elaichi)	1.00
Fenugreek	0.30
Cloves (Laung)	0.20
Coriander (Dhania)	5.00
Cumin seeds (Zeera)	4.00
Ginger (powder)	3.00
Garlic (powder)	3.00
Onion (powder)	25.00
Sugar	3.00
Salt	2.00
starch	24.80
Carrot (powder)	18.00
Monosodium glutamate (msg)	0.5
Total	100.00

Source: Verma

lakhdoom, Mathura. The TPA of noodles was determined as per the ethod described by Bourne (1978). The noodles were compressed to mm of height through a miniature Ottowa and Kramer shear cell obe. A crosshead speed of 2.00 mm/s, post-test speed of 10.00 mm/s d a target mode of space with 10.00 mm were used for the evaluation of e texture of the noodles.

icrobiological quality

icrobial quality (Standard plate counts, SPC), Coliforms counts (CC), *aphylococcus* spp. counts (SCC). Yeast and Mold counts (Y and M)) of the mples were determined as per the methods described by the American blic Health Association APHA (1984). The *Salmonella* spp. count was estimated as per the method mentioned in the OIE Terrestrial Manual (2008) which is based on the ISO standard (6579:2002) with certain modifications, such as an addition of a Novobiocin supplement to the Xylose Lysine Deoxycholate agar.

Sensory attributes

In total a nine semi-experienced panel of judges consisting of teachers and postgraduate students of the College of Veterinary Science and animals husbandry (DUVASU), Mathura, evaluated the samples for the sensory quality such as appearance and color, flavor, texture, mouth-coating, saltiness, meat flavor intensity and overall acceptability using an eight points descriptive scale (Keeton, 1983), where 8 = extremely desirable and 1 = extremely undesirable.

Statistical analysis

The data collected was analyzed statistically on the Systat software package as per the method of Snedecor and Cochran (1994). The samples were drawn in duplicate for all parameter and the trial was conducted thrice (n = 6). The sensory attributed was conducted by a jury of nine member judges by three times, resulting in a total of 27 (n = 27) observations. A two ways Anova, homogeneity test and Duncan's Multiple Range Test were employed for comparing the means to find the effects between groups and storage periods. The statistical significance was expressed at ($P<0.05$).

Results and Discussion

Change in nutritional quality of soy-chicken noodles

The pH value of the noodles prepared from soybean flour showed a reduction at each interval of estimation till day 30 of storage. The moisture content did not differ significantly ($P>0.05$) among the treatment and control during the whole storage study (Tab. 3). The moisture content increased significantly ($P<0.05$) in control as well as in the treated group during the entire study. Similar results were also reported by Anderson et al. (1969) for noodles during a storage study. This finding was also supported by the results of Anandh et al. (2005) who observed non-significant ($P>0.05$) differences in the moisture content of an extruded tripe snack food and control when stored for a period of 30 days. The mean values of the fat content differed significantly ($P<0.05$) among the control and treated group during the entire storage study (Tab. 3). The fat content decreased in all variants during storage.

However, the reduction in fat percentage was non-significant ($P>0.05$) in control and differs significantly ($P<0.05$) in the treatment at day 0 and

Tab. 3: Change in nutritional quality of soy-chicken noodles stored at ambient temperature under aerobic packaging

Parameters	Group	Day 0	Day 10	Day 20	Day 30
Moisture	C	$9.443^{Ba}\pm0.018$	$9.472^{a}\pm0.024$	$9.482^{ab}\pm0.0139$	$9.549^{b}\pm0.024$
	T	9.343Aa±0.036	9.436b±0.020	9.518c±0.031	$9.589^{c}\pm0.020$
Fat	C	$9.606^{Bb}\pm0.179$	$9.466^{Bab}\pm0.206$	$9.291^{Ba}\pm0.182$	$9.160^{Ba}\pm0.165$
	T	$6.081^{Ab}\pm0.125$	$5.94^{Aab}\pm0.120$	$5.835^{Aab}\pm0.110$	$5.56^{Aa}\pm0.107$
Protein	C	$40.602^{B}\pm0.540$	$40.605^{B}\pm0.444$	$40.588^{B}\pm0.858$	$40.433^{B}\pm0.525$
	T	$22.195^{A}\pm1.1228$	$21.979^{A}\pm0.7140$	$21.789^{A}\pm0.976$	$21.624^{A}\pm1.331$
Crud fiber	C	$8.308^{B}\pm0.069$	$8.134^{B}\pm0.067$	$8.049^{B}\pm0.091$	$7.994^{B}\pm0.078$
	T	$4.972^{A}\pm0.045$	$4.859^{A}\pm0.023$	$4.813^{A}\pm0.019$	$4.723^{A}\pm0.023$
Ash	C	5.737±0.152	$5.618^{A}\pm0.155$	5.52±0.133	5.417±0.144
	T	$6.03^{b}\pm0.088$	$5.997^{Bab}\pm0.091$	$5.85^{ab}\pm0.107$	$5.608^{a}\pm0.131$

Mean ± S.E. with different superscripts row wise (small alphabets) and column wise (capital alphabets) differ significantly ($P<0.05$).
C = Control noodles, T = Chicken meat incorporated noodles
Source: Verma

Tab. 4: Change in physico-chemical quality of soy-chicken noodles stored at ambient temperature under aerobic packaging (Mean±SE)

Parameter	Group	Day 0	Day 10	Day 20	Day 30
pH	C	$6.07^{Bc}\pm0.007$	$5.78^{Ab}\pm0.006$	$5.80^{Aab}\pm0.006$	$5.82^{a}\pm0.007$
	T	$6.01^{Ac}\pm0.014$	$6.01^{Bc}\pm0.011$	$5.91^{Bb}\pm0.009$	$5.84^{a}\pm0.012$
a_w	C	$0.445^{Aa}\pm0.0007$	$0.449^{Aa}\pm0.0006$	$0.459^{Aa}\pm0.002$	$0.471^{Aa}\pm0.002$
	T	$0.454^{Ab}\pm0.001$	$0.461^{Bb}\pm0.001$	$0.482^{Bb}\pm0.001$	$0.494^{Bb}\pm0.001$
TBARS	C	$0.192^{a}\pm0.011$	$0.270^{b}\pm0.006$	$0.338^{c}\pm0.014$	$0.508^{Bd}\pm0.028$
	T	$0.173^{a}\pm0.015$	$0.245^{b}\pm0.010$	$0.317^{c}\pm0.012$	$0.433^{Ac}\pm0.016$
FFA	C	$0.075^{Ba}\pm0.0008$	$0.080^{Ba}\pm0.0007$	$0.091^{Bb}\pm0.002$	$0.11^{Bc}\pm0.005$
	T	$0.068^{Aa}\pm0.0011$	$0.071^{Aa}\pm0.0012$	$0.078^{Ab}\pm0.0008$	$0.092^{Ac}\pm0.0015$
WAI	C	$2.531^{Ba}\pm0.044$	$2.574^{Ba}\pm0.035$	$2.608^{Bab}\pm0.0382$	$2.691^{Bb}\pm0.037$
	T	$2.144^{A}\pm0.041$	$2.151^{A}\pm0.045$	$2.163^{A}\pm0.018$	$2.216^{A}\pm0.031$
WSI	C	$0.117^{B}\pm0.006$	$0.116^{B}\pm0.004$	$0.115^{B}\pm0.003$	$0.112^{B}\pm0.003$
	T	$0.083^{A}\pm0.002$	$0.081^{A}\pm0.002$	$0.077^{A}\pm0.002$	$0.076^{A}\pm0.002$

Mean±S.E. with different superscripts row wise (small alphabets) and column wise (capital alphabets) differ significantly ($P<0.05$)
n = 6; C = Control noodles, T = Chicken meat incorporated noodles

Source: Vrama

30 of storage. Singh et al. (2011) also found a decrease in the fat content in chicken meat snacks during storage. The decrease in the fat contents during storage might be due to an increase in the moisture content and a fat utilization by the lipolytic bacteria during storage. The protein content was significantly ($P<0.05$) higher in the chicken meat incorporated noodles as compared to the control (Tab. 3). No significant differences ($P>0.05$) were observed in the protein contents of control and treated noodles during the entire storage study. The protein content in the present study was almost similar to that reported by Singh et al. (2002) in chicken snacks containing 50% broiler spent hen meat. The crude fiber content differed significantly ($P<0.05$) between the control and treatment with the advancement of the storage period (Tab. 3).

The values of the fiber content decreased significantly ($P<0.05$) in the control and non-significantly ($P>0.05$) in the test products at all days of storage. This finding was very well supported by Bushway et al. (1985) who worked on canned and frozen fiddlehead greens and reported an around 25% decrease in crude fiber till ten months of storage. The ash content was higher in the treatment than in the control and the values differed significantly ($P<0.05$) in both treatments as well as control up to day 30 of storage (Tab. 3). The reason for the decreased ash content in chicken meat noodles during storage might be due to gain of moisture and utilization of nutrients by microbes.

Change in physico-chemical quality of soy-chicken noodles

The pH values decreased in the control and the meat incorporated noodles throughout the storage (Tab. 4). The decrease in pH between control and meat incorporated noodles differed significantly ($P<0.05$) up to day 20 of storage. The differ in the pH values and the changes during storage might be due to differences in the formulation composition of noodles and as well as due to the formation of organic acids due to the microbial proliferation during the storage. Kumar et al. (2016) also observed a decrease in pH values during the storage of chicken meat biscuits incorporated with wheat and oat bran at ambient temperature. The water activity of the stored noodles increased significantly ($P<0.05$) in control and treated noodles (Tab. 4).

Meat incorporated noodles had a significantly ($P<0.05$) higher water activity as compared to the control at each day of analysis. In general water activity values of snacks and meat products during storage increased due to an absorbance of moisture from the surrounding space. Increases in the moisture content of noodles throughout storage also support increased a_w. The thio-barbituric acid reactive substances (TBARS) values also increased during the storage in control and meat noodles, respectively (Tab. 4). The increase in the TBARS values during the storage in both groups might be due to the formation of aldehydes during the storage due to enzymatic and microbial deterioration. The comparatively higher TBARS values estimated in control as compared to the meat noodles might be due to the higher fat content in the control noodles in comparison to the meat incorporated noodles. But the TBARS values remained below the recommended level. Free fatty acid is the end products of the lipid oxidation and these FFA decreased the acceptability of meat products and it is also harmful to consumer health.

The free fatty acid (FFA) content was significantly ($P<0.05$) higher in control than in meat noodles throughout storage (Tab. 4). The FFA value also increased as the day of storage advanced. Fritsch (1981) reported that an increase in FFA might be due to a hydrolysis of the fat content, initiated by the moisture present in food due to the oxidation reaction. These findings were in line with the result reported by Kaur et al. (2012) for pasta prepared with various flours. Modi et al. (2007) also reported that at the day of formulation a dehydrated chicken kebab mix had FFA values of 0.99%, which significantly increased up to 1.74% during the end of storage.

The water absorption index (WAI) values were comparatively ($P<0.05$) higher in the control as compared to the meat noodles during the entire study (Tab. 4). The higher WAI in the control noodles might be due to the higher starch content in the control than in the meat noodles. The WAI of the noodles also increased due to an increased starch gelatinization. However, the WAI increased during storage in both groupes but it differs significantly ($P<0.05$) in the control and remained comparable in the treatment throughout the storage. Akin results were also reported by Ramya et al. (2014) and Vijaykrishnaraj et al. (2014) for pasta prepared with an incorporation of shrimp meat and green mussel powder. As the levels of shrimp meat and green mussel powder increased the WAI values decreased significantly during storage.

However, the contrast results were reported by Devi et al. (2013) for pasta prepared with the addition of fish mince. Similarly, the water solubility index (WSI) was comparatively ($P<0.05$) higher in the control than in the meat noodles (Tab. 4). However, the water solubility index decreased non-significantly ($P>0.05$) during the storage between both groups. The

Tab. 5: Change in microbial quality of soy-chicken noodles stored at ambient temperature under aerobic packaging (Mean±SE)

Parameter	Group	Day 0	Day 10	Day 20	Day 30
Standard plate count	C	1.310^{a}±0.271	2.145^{a}±0.033	3.097^{a}±0.058	3.812^{a}±0.039
	T	1.596^{a}±0.324	2.285^{b}±0.030	3.209^{b}±0.039	3.837^{b}±0.025
Yeast and mould	C	0±0	0.384^{a}±0.248	0.897^{a}±0.285	1.034^{a}±0.226
	T	0±0	0.50^{a}±0.224	1.179^{b}±0.085	1.063^{a}±0.231

Mean ±S.E. with different superscripts row wise (small alphabets) and column wise (capital alphabets) differ significantly ($P<0.05$)
n = 6; C = Control noodles, T = Chicken meat incorporated noodles

Source: Verma

decrease in the WSI value during storage might be due to the deterioration of the starch and protein quality during storage.

Change in microbial quality of soy-chicken noodles

Low microbial counts in any food items indicate hygienic manufacturing, quality of ingredients and freshness of the products. The Standard Plate Counts (SPC) and yeast and mold counts in the control noodles were slightly lower than in the meat noodles throughout storage (Tab. 5). The higher SPC and yeast and mould counts in the chicken meat noodles as compared to the control might be due to the higher microbial load in meat during the contamination by slaughtering and dressing. However, during storage as the days of storage prolong the SPC and yeast and mold counts increased significantly ($P<0.05$) in both groups. In general, the SPC and yeast and mold counts were higher in the meat noodles during storage. That might be due to the presence of more essential growth factors in the meat noodles than in the control (Tab. 5). Coliforms Counts (CC), *Staphylococcus* spp. counts (SCC) and *Salmonella* spp. were not detected during the entire storage study. Similar outcomes were also reported by Cakmak et al. (2016) for CC in crispy bread snacks incorporated with chicken meat and chicken meat powder and by Deeptii et al. (2011) for SCC and *Salmonella* spp. in egg paneer prepared with egg albumen.

Change in texture quality of soy-chicken noodles

Textural profile is one of the most important eating qualities of noodles because it directly correlated with consumer's likeness. The hardness and shearing value of the control and the meat added noodles remained non-significantly ($P>0.05$) up to day 10 of storage and differ significantly ($P<0.05$) on day 20 and 30 of storage (Fig. 3). The higher hardness and shearing value in meat noodles were observed at end of storage in comparison to the control.

However, the hardness and shearing values decreased during storage in both control and meat noodles. The decrease in hardness and shearing values during storage might be due to the weakening of solid lattice structures of the noodles and an association between the soybean flour and chicken meat during the storage period. Our previous findings such as increased in WAI, decreased in WSI and an increase in the moisture content has also supported the decrease in hardness and shearing value. The crispiness values differ significantly ($P<0.05$) at day 10 and 20 of storage between the control and the chicken meat noodles. The crispiness values increased in both groups during the storage. The increase in crispiness values in both groups of noodles might be due to the decreased association between the meat protein and soy flour during the storage

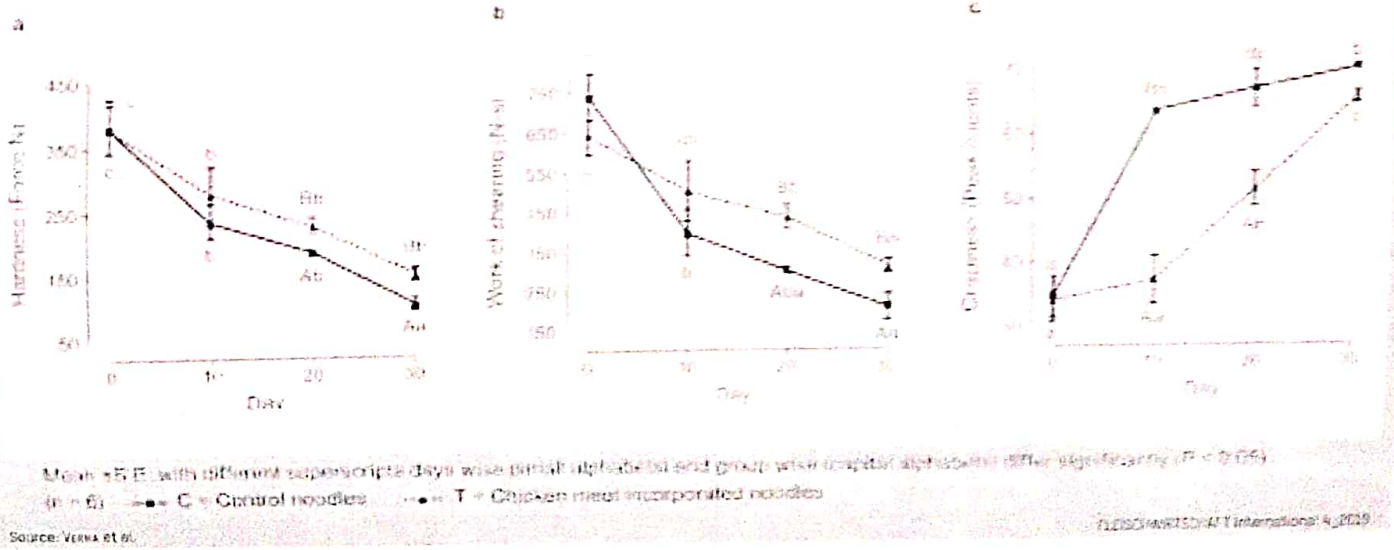


Fig. 3: Changes in texture quality of soya-chicken noodles stored at ambient temperature under aerobic packaging (Mean±SE)

Tab. 6: Change in sensory quality of soy-chicken noodles stored at ambient temperature under aerobic packaging (Mean±SE)

Parameter	Groups	Day 0	Day 10	Day 20	Day 30
Appearance and color	C	5.778^{Aa}±0.123	5.630^{Ab}±0.121	5.630^{Ab}±0.132	5.481^{Ac}±0.111
	T	6.667^{Aab}±0.131	6.593^{Bab}±0.110	6.407^{Bab}±0.111	6.259^{Bb}±0.137
Flavor	C	4.852^{Ba}±0.138	4.667^{Aa}±0.141	4.593^{Aa}±0.122	4.519^{Aa}±0.098
	T	6.259^{Bb}±0.114	6.111^{Bb}±0.123	6.000^{Bb}±0.131	5.926^{Bb}±0.129
Texture	C	5.333^{Aab}±0.131	5.185^{Aab}±0.120	4.963^{Aab}±0.136	4.778^{Aab}±0.123
	T	6.222^{Bb}±0.134	5.926^{Bab}±0.106	5.741^{Bab}±0.126	5.667^{Bab}±0.131
Mouth coating	C	5.148^{Aa}±0.128	4.963^{Aab}±0.113	4.889^{Aab}±0.111	4.741^{Aab}±0.126
	T	6.481^{Bb}±0.112	6.296^{Bab}±0.104	6.111^{Bab}±0.123	5.889^{Bab}±0.134
Saltiness	C	5.333^{Aab}±0.119	5.185^{Aab}±0.093	4.926^{Aab}±0.119	4.889^{Aab}±0.134
	T	5.852^{Bab}±0.138	5.629^{Bab}±0.121	5.556^{Bab}±0.111	5.481^{Bab}±0.123
Meat flavor intensity	C	0A±0	0A±0	0A±0	0A±0
	T	6.111^{Bc}±0.146	5.852^{Bb}±0.148	5.667^{Bb}±0.119	5.593^{Bb}±0.122
Over all acceptability	C	4.815Ab±0.120	4.704Ab±0.104	4.667A±0.119	4.556^{Ab}±0.123
	T	5.925^{Bab}±0.129	5.740^{Bab}±0.114	5.629^{Bab}±0.108	5.556^{Bab}±0.097

Mean±S.E. with different superscripts row wise (small alphabets) and column wise (capital alphabets) differ significantly ($P<0.05$)
n = 6; C = Control noodles, T = Chicken meat incorporated noodles

Source: Verma

which leads to the reduced force required for the fragmentation of noodles increasing the crispiness.

Change in sensory quality of soy-chicken noodles

Sensory is very important because it directly affects the eating quality of products. The chicken meat noodles had comparatively better sensory attributes than the control noodles (Tab. 6). This might be due to the unique flavor and color of the meat. All sensory attributes during storage decreased in both groups of noodles throughout storage. The reduction in sensory scores correlated with the findings of Sharma and Nanda (2002), who also stated a considerable decrease in the sensory attributes of chicken chips stored at room temperature. The decrease in the sensory quality of noodles during storage might be due to the oxidation of fat and microbial deterioration. A gradual increase in the FFA and TBARS content (Tab. 2) in this study also confirms the decreasing trend in the sensory quality during storage of control and meat noodles.

Conclusions

Meat noodle is a convenience and ready-to-use product prepared with soy and chicken meat. Changes in the quality of the stored products were evaluated in this study. Chicken meat noodles packed in LDPE pouches remained nutritionally good in quality and had a shelf life of one month at room temperature. The noodle does not contain any added food preservative and is high in protein. The low water activity of the noodle acts like a hurdle so the product remained stable during storage. The FFA and TBARS index was low and below the prescribed limits due to the low moisture content in the noodle. The microbial counts have also remained below the critical limits throughout the storage study of the developed chicken meat noodle. In conclusion, the developed chicken meat noodle is a shelf-stable meat product when packed in LDPE pouches at room temperature. The prepared chicken meat noodle can be recommended under various nutritional programs as a healthy meal due to its acceptability, high-quality protein and shelf stability. Further investigation of the effect of the various packaging systems, the addition of bio-preservatives in the developed chicken meat noodles and its storage stability as well as the effect on sensory quality is required.

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Development of fortified Biscuit incorporating with mung flour and milk powder and assessment of physical properties

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Abstract

Fortified flour was prepared by blending wheat flour with mung flour and milk powder in ratios of 100:0:0, 90:5:5, 80:10:10 and 70:15:15 respectively and packaged in glass jar for further experiment to develop biscuits. The mass, diameter and thickness of biscuits are important to design the mould and cast of the biscuit. The study revealed that the mass and thickness of fortified biscuits decreased with increase in the incorporation of mung flour and milk powder with wheat flour. The value of mass of control (wheat flour) biscuits was lowest as compared to other fortified biscuits.

Keywords: Fortification, Biscuits, powder, mung flour, physical properties

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Introduction

Food fortification is one way of solving nutrient deficiencies in developing countries, and so far the implementation of those programs has been very successful for correcting nutritional deficiencies within a very short period. In the developing countries, it should be taken into account that the food selected as a vehicle for the nutrient should be stable and consumed by the population at risk, and the amount of nutrient added should be sufficient to correct the possible deficiency.

In general, all the rice-consuming countries have a vitamin A deficiency, which is associated with corneal lesions that can lead to partial or total blindness, and also with reduced resistance to infectious diseases, and in consequence an increased morbidity and mortality. Another deficiency associated with rice-consuming countries cause nutritional anemia due to iron deficiency, which has been linked to reduced resistance to infections and also effects on cognitive development and physiological functions in children, and in severe cases of deficiency causing maternal deaths. Iodine constitutes the third major deficiency in rice-consuming countries. This mineral is necessary for correct fetal development and also for normal physical and mental activities in adults.

Cereals grains contain about 10-14 % moisture, 58-72 % carbohydrates, 8-13% protein, 2-5 % fat, and 2-11 % indigestible fibre. They are also containing 300-350 kcal/100 g of

the grain. Cereals grains contain about two-thirds carbohydrates, most of which is in the form of digestible starches and sugars. The operations of milling generally remove much of the indigestible fibre and fat from the grains when they are to be consumed as human food (Potter and HotchKiss, 1996). Cereals do not contain vitamin A or vitamin C (Rama Krishnan and Venkat Rao, 1995). Soft wheat is used in cakes, pastries, cookies, crackers and oriental noodles where as hard wheat is used in breads. When hard wheat and soft wheat dried salt noodles with similar protein content were compared the hard wheat noodles were generally darker and stronger but less firm at the surface (Oh *et al.,* 1985a). Around 1100 large roller flour mills in the country convert about 10.50 million tones of wheat into wheat products. Moreover 2, 60,000 small flour mills are engaged in primary milling of wheat (Malik and Singh, 2010).

Amongst legumes, mung bean (*Vigna radiate* L. Wilczek) is an excellent source of high quality protein and is one of the cheapest and richest sources of plant protein (Akaerue and Onwuka, 2010). Moreover, mung bean is rich in essential fatty acids, antioxidant and minerals (Kolloarova *et al.,* 2010). Therefore, mungbean-wheat flour blends was used as alternate or in combination with other ingredients in many food products (Kenawi *et al.,* 2009). Consumption of mungbean supplemented products can fulfill requirements of essential amino acids (Iqbal et al., 2006). Milk is an important part for manufacturing the biscuits. Thus keeping above all facts, present study has been designed to prepare the wheat-mungbean-milk powder blends. The quality estimation and their potential application in cereal based products are the limelight the manuscript. The outcomes of the present research are important for all stakeholders to devise strategy to culminate the menace of protein energy malnutrition through blending of wheat-mungbean flour with milk powder.

Material and Methods

The entire research work was conducted at Division of Quality Assurance, Gangol Dugdh Utpadak Sagkari Sangh (Parag Dairy) Partapur, Meerut and Food Processing Unit, Department of Agricultural Engineering, S.V.P. University of Agric. & Tech., Meerut (U. P.). Various instruments / equipment namely Deck oven, convective oven, spiral mixer, grinder, electronic balance, hot air oven, muffle furnace, digital pH meter, digital spectrophotometer, etc were used for the research work. Raw materials viz., wheat flour (maida or refined flour), mung flour, potato, other ingredients, packaging materials (glass jar) were procured from the local market of Meerut for the present study.

Development of Biscuit from fortified flour

The fortified flour biscuits were prepared from various combinations of wheat flour, mung flour and milk powder. The standardized formulations for biscuit had ingredients as 100 g flour, 40 g sugar, 25 g hydrogenated fat, 1.5 g sodium bicarbonate, 1.5 g baking powder and 1.0 g antioxidant. Hot liquid Hydrogenated fat and sugar were taken and creamed to a uniform consistency. The flour, required amount of water, baking powder, antioxidant and sodium bicarbonate were added to creamed mixture and mixed for 10 min at medium speed in dough mixer to obtain a homogeneous mixture. The dough was rolled out into thin sheet of uniform thickness and was cut into desired shape using mould. The cut pieces were placed over perforated tray and transferred into convective baking oven at 150^0C for 20-30 min till baked. The well baked biscuits were removed from the oven, cooled to room temperature, packaged and stored at room temperature for further studies.

Proximate analysis of Biscuit

The moisture of biscuits was analytically estimated by the methods as recommended by AOAC (2000). The pH, acidity and browning index (optical density) was determined by using the method as recommended by Ranganna (2001).

Assessment of physical properties of biscuits

Diameter: The diameter of biscuits was measured by laying five biscuits edge to edge with the help of a scale rotating those at 90^0 and again measuring the diameter of five biscuits (cm) and finally average value was considered (Chandra *et al.,* 2015).

Thickness: Thickness was measured by stacking five biscuits on a top of each other and average thickness (cm) was considered.

Mass: Mass of biscuits (g) was measured as average of values of five individual biscuits with the help of digital electronic weighing balance.

Spread Ratio: Spread ratio was calculated by dividing the average value of diameter by average value of thickness of biscuits.

Per cent spread: Per cent spread was calculated by dividing the spread ratio of composite biscuit with spread ratio of control biscuits and multiplying with 100.

Bulk Density: The bulk density was determined according to the method described by Okaka and Potter (1977). Fifty (50) g sample of biscuits was put into a 100 ml graduated cylinder. The cylinder was tapped 40-50 times and the bulk density was calculated as weight per unit volume of samples.

Results and Discussion

The present study was undertaken to develop fortified biscuits from the composite flours. The wheat flour (refined flour) was blended with mung flour and milk powder in various combinations to prepare composite flours. The effect of incorporation ratio of flours were observed on moisture content, acidity, pH and non enzymatic browning or optical density); physical attributes (Thickness, mass, diameter, spread ratio, percent spread and bulk density) of fortified biscuits. The reported values are mean of three replications with statistical analysis using OPSTAT software.

Effect on Moisture Content: The moisture content of biscuits samples varied from 2.83 to 3.03 per cent. The values of moisture content for freshly prepared biscuits was highest for W_{70} biscuits (3.03 %) followed by W_{80} (3.01 %) and W_{90} (2.91 %) while lowest for control biscuits (2.83%). The moisture content of fortified biscuits was higher as compared to control biscuits (Table 1). It was increased with increase in the incorporation of mung flour and milk powder with flour. Similar trends were found by Anu *et al.,* (2007). They prepared biscuits from refined flour, pearl millets and mung in the ratio of 50:40:10 (type I) and 30:60:10 (type II). From Table 1 indicated that the control biscuits absorbed higher moisture from the ambient as compared to other samples because of wheat flour had higher hygroscopicity property than others flours.

Effect on Acidity: From Table 1, it could be seen that the acidity decreased with increase the incorporation of mung flour and milk powder with wheat flour. The acidity was measured highest for control biscuits followed by W_{90}, W_{80} and lowest in W_{70} biscuits. Overall range of acidity among all the samples varied 0.153 to 0.182 %. In the view of above, acidity decreased with decreasing in the proportions of wheat flour in biscuit formulation. The effect of incorporation of flours on acidity of biscuits were found to be significant at $p<0.05$ level of significance.

Effect on pH: The effect of incorporation of mung flour and milk powder on pH of biscuits are presented in Table 1. The pH range for fresh

biscuits was observed 6.55-6.80 among all the biscuits samples. Highest pH was found for W_{70} biscuits (6.80) followed by W_{80} (6.70), W_{90} (6.60) while lowest for control biscuits (6.55) just after baking. The result of study revealed that the pH of biscuits increased with increasing the incorporation of mung flour and milk powder with wheat flour. The effect of incorporation of flours on pH of biscuits were found to be significant at $p<0.05$ level of significance. Highest pH was observed for W_{70} biscuits while lowest for control biscuits as compared to others.

Table 1: Proximate analysis of fresh fortified biscuits

Proximate composition	Biscuits				$CD_{5\%}$
	W_{100}	W_{90}	W_{80}	W_{70}	
Moisture, %	2.83±0.026	2.91±0.020	3.01±0.034	3.03±0.020	0.053
Acidity, %	0.182±0.002	0.165±0.002	0.160±0.007	0.153±0.005	0.011
pH	6.55±0.053	6.60±0.045	6.70±0.045	06.80±0.026	0.115
NEB (OD)	0.181±0.002	0.193±0.005	0.196±0.007	0.203±0.008	0.009

Description

W_{100} = Wheat flour (100 %)
W_{90} = Wheat flour (90 %) + mung flour (5%) + milk powder (5%)
W_{80} = Wheat flour (80 %) + mung flour (10%) + milk powder (10%)
W_{70} = Wheat flour (70 %) + mung flour (15%) + milk powder (15%)

Effect on Non enzymatic browning (optical density): The effect of incorporation of mung flour and milk powder on Non enzymatic browning (optical density) of biscuits is presented in Table 1. Optical density is the physical property associated to the presence of pigment in any sample. Non enzymatic browning (NEB) of biscuits was found to have increased with increase in the incorporation of mung flour and milk powder with wheat flour. Highest NEB was observed for W_{70} (0.203) followed by W_{80} (0.196), W_{90} (0.193) and lowest for control biscuits (0.181) as a fresh samples. The increase in Non enzymatic browning during baking was due to maillard reaction or interaction between protein and sugar or amino acids and sugar or organic acids and sugars. Mung flour and milk powder led to enhance the browning index of biscuits during baking due to enzymatic reactions and caramelization of sugar.

Physical properties of fortified biscuits

The knowledge of important physical properties such as shape, size, volume, surface area, density, length, thickness, spread ratio, per cent spread and mass of biscuits is necessary for designing of baking equipment, packaging materials, handling and storage systems. These properties are also helping to calculate the energy and mass balance during baking. The mass, diameter and thickness of biscuits are important to design the mild and cast of the biscuit. The effect of incorporation of flours on physical properties of freshly prepared biscuits were analyzed and discussed as follows.

Effect on Mass: The variation in mass (g) of biscuits is given in Table 2. The mass per biscuit ranged 6.80 to 8.40g. The highest mass per biscuit was measured for W_{90} biscuit (8.40g) followed by W_{80} (8.20 g), W_{70} (7.80g) and lowest for wheat flour biscuit (6.80g). The study revealed that the mass of fortified biscuits increased with increase in the incorporation of mung flour and milk powder with wheat flour. The value of mass of control (wheat flour) biscuits was lowest as compared to other fortified biscuits. The mass of biscuits was affected by the mass of dough taken for making the biscuit. The biscuits had variation in the

initial weight and size of biscuit due prepared by manually. Similar trends were found by Mridula and Wanjari (2006) and Chandra *et al.,* (2015). They reported that weight of biscuit decreased gradually with increase in proportion of full fat soybean flour from 5 to 20 per cent and decreasing the proportion of wheat flour 100 to 80 per cent. From this, it is clear that the effect of incorporation mung flour and milk powder with wheat flour on mass of biscuit were found to be non-significant at $p<0.05$. The study was accounted that the mass of biscuit increased with increase in the incorporation of other ingredients with wheat flour.

Tables 2: Physical properties of fortified biscuits

Biscuits	Mass (g)	Diameter (cm)	Thickness (cm)	Spread ratio	Per cent spread	Bulk density (g/cc)
W_{100}	6.80	4.25	0.96	4.43	100.00	0.499
W_{90}	8.40	4.40	1.10	4.00	90.29	0.395
W_{80}	8.20	5.58	1.05	5.31	119.86	0.397
W_{70}	7.80	4.80	0.73	6.16	139.05	0.591
$CD_{5\%}$	NS	NS	NS	NS	10.779	NS

Description

W_{100} = Wheat flour (100 %)
W_{90} = Wheat flour (90 %) + mung flour (5%) + milk powder (5%)
W_{80} = Wheat flour (80 %) + mung flour (10%) + milk powder (10%)
W_{70} = Wheat flour (70 %) + mung flour (15%) + milk powder (15%)

Effect on Diameter: The value of diameter of biscuits ranged 4.25 to 5.58 cm. The highest diameter was observed for W_{80} biscuits (5.58 cm) followed by W_{70} (4.80 cm) and W_{90} (4.40 cm) and lowest for control biscuits (4.25 cm). It is clear that the diameter of fortified biscuits had larger as compared to control biscuits (Table 2). The diameter of fortified biscuits increased with increase in the incorporation of mung flour and milk powder with wheat flour. Diameter and spread ratio of biscuits are the important parameter used for evaluation the wheat varieties for biscuits making (Nemeth *et al.,* 1994). Larger biscuit diameter and higher spread ratio are considered as the desirable quality attributes (Yamamoto *et al.,* 1996). Similar findings were observed by Yadav *et al.,* (2012) and Chandra *et al.,* (2015). It could be seen that the incorporation of mung flour and milk powder with wheat flour had non-significant effect at $p<0.05$ level of significance. This study revealed that diameter of biscuits decreased insignificantly with increase in the incorporation of different flours with wheat flour. The control biscuits had smaller diameter (4.25 cm) and larger for W_{80} biscuits (5.58 cm).

Effect on Thickness: Data on the physical parameter like thickness of biscuits as affected by the incorporation of mung flour and milk powder with wheat flour are presented in Table 2. The thickness per biscuit ranged 0.73 to 1.10 cm. The highest thickness per biscuit was measured for W_{90} biscuit (1.10 cm) followed W_{80} (1.05 cm), W_{100} (0.96 cm) and lowest for W_{70} (0.73 cm). From the study revealed that the thickness of biscuits decreased with increase in the incorporation of mung flour and milk powder with wheat flour. Highest value of thickness was observed for W_{90} biscuits as compared to control biscuits. The thickness of biscuits was influenced by the initial mass of the dough ball which was taken for the preparation of biscuits. Decrease in diameter and thickness of fortified biscuits with other flours with wheat

flour may be due to dilution of gluten. Similar results were reported by Ajila *et al.,* (2008) and Chandra *et al.,* (2015). It is clear that the incorporation of different flours with wheat flour on thickness of biscuits were found to be non significant at $p<0.05$ level of significance.

Effect on Spread Ratio: The spread ratio is the ratio of diameter to thickness of biscuits. The variation in spread ratio for biscuits is given in Table 2. The spread ratio of biscuits ranged 4.00 to 6.16. The highest spread ratio was evaluated for W_{70} biscuits (6.16) followed by W_{80} (5.31), W_{100} (4.43) and lowest for W_{90} biscuits (4.00). The results indicated that the incorporation of other ingredients with wheat flour increased the spread ratio of biscuits. Spread ratio of W_{90} biscuits was found lower than control biscuits but higher for W_{80} and W_{70} biscuits. Results were also revealed that the spread ratio of fortified biscuits increased with decrease in the incorporation of wheat flour in fortified flours. It is clear that spread ratio is mostly influenced by the diameter and thickness of biscuits. Spread ratio and per cent spread decreased with addition of mung flour and milk powder. Rababah *et al.,* (2006) reported the reduction in spread ratio when chickpea, broad bean and isolate soy protein were substituted for wheat flour in biscuits. Hence, it was observed that the spread ratio of biscuit were found to be non significant as compared to control biscuits at $p<0.05$ level of significance. Spread ratio of the fortified biscuits increased with increase in the incorporation of mung flour and milk powder.

Effect on Per cent Spread: The experimental data for variation in per cent spread of biscuits is shown in Table 2. The per cent spread of biscuits varied 90.29 to 139.05. The highest score of per cent spread were observed for W_{70} biscuits (139.05) followed W_{80} (119.86), control biscuits (100.00) and lowest for W_{90} biscuits (90.29). The study revealed that the per cent spread of biscuit increased with increase in the incorporation of mung flour and milk powder with wheat flour. The per cent spread of biscuits increased with decrease in the incorporation of wheat flour. Per cent spread of biscuits was influenced by the thickness and diameter of biscuits. Adair *et al.,* (2001) found that mung bean paste incorporation reduced cookie spread at all the level of substitutions (25, 50, 75 and 100%) of peanut butter which was not similar to present study. Mandal *et al.,* (2004) reported that incorporation of 25 per cent mung flour in the formulation of biscuit improved height, diameter, spread ratio, colour, texture and flavour. Similar result was quoted by Chandra *et al.,* (2015). Study revealed that the per cent spread of biscuits were affected significantly at $p<0.05$ level of significance. The spread ratio of biscuit was found to be significant as compared to control biscuits.

Effect on Bulk density: The variation in bulk densities of biscuits are reported in Table 2, which shows the effect of incorporation of mung flour and milk powder with wheat flour. Bulk densities of biscuits ranged 0.395 to 0.591 g/cc. The highest bulk density was reported for W_{70} biscuits (0.591 g/cc) followed by W_{100} (0.499g/cc), W_{80} (0.397 g/cc) and lowest for W_{90} biscuits (0.395 g/cc). It was also noticed that level of incorporation of different ingredients was influenced the bulk density of biscuits. From Table 1, it was observed that the bulk densities among all biscuit samples decreased with increase in the incorporation of mung flour and milk powder with wheat flour, while decreased with decrease in the proportions of wheat flour in composite flours. Hence, bulk density of biscuits depends on the particle size of incorporating flours which reduced by coarse size of potato flours in biscuits. Akubor and Obiegbuna (1999) reported that bulk density of sample could be used in determining its packaging requirements as this related to the load the sample being stacked and allowed to

rest directly on one another. The density is often noted as an important quality parameter in biscuit making, in particular for predicting crunchiness (Bartalucci and Launay, 2000). Lower density is often suggested as a quality index for biscuits (Fustier *et al.,* 2009). Study also revealed that the bulk density of biscuits were found to be non significant at $p<0.05$ level of significance. It is clear the bulk density decreased non-significantly with increase in the incorporation of different flours with wheat flour. Highest bulk density was found for W_{70} biscuits while lowest for W_{90} biscuits at $p<0.05$ level of significance.

Conclusion

The moisture content, pH, non enzymatic browning (NEB) of fortified biscuits had higher as compared to control biscuits. It was increased with increase in the incorporation of mung flour and milk powder with flour. The acidity decreased with increase the incorporation of mung flour and milk powder with wheat flour. The mass, diameter and thickness of biscuits are important to design the mould and cast of the biscuit. The study revealed that the mass and thickness of fortified biscuits decreased with increase in the incorporation of mung flour and milk powder with wheat flour. The value of mass of control (wheat flour) biscuits was lowest as compared to other fortified biscuits. The diameter, spread ratio, percent spread and bulk density of fortified biscuits increased with increase in the incorporation of mung flour and milk powder with wheat flour. Percent spread of biscuits was influenced by the thickness and diameter of biscuits.

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14

Hybrid Seed Production Technology of Pearl Millet in India

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Introduction

Functional and healthy seed is one of the important factors in improving agricultural production. Farmer-based seed production programs for sorghum have been introduced in some of the developing countries and are proving to be successful. The onus of responsibility in terms of producing improved cultivars (plant-type selection, composition and hybrids) are breeding, commercial seed production and certification. While breeding is carried out by a research station, commercial production and distribution require an well-organized operation. Certification is carried out by independent agencies that monitor the quality and purity of the cultivar during production. The procedures for seed production of the open-pollinated varieties differ from those hybrids. Pearl millet, also called cowpea millet, , cereal grain plant of the grass family (Poaceae) and its edible starchy seeds. The plant likely originated in Africa, where it is a staple food crop, and has numerous varieties, including grain sorghums, used for food, grass pearl millet, grown for hay and fodder, and broomcorns, used in making brooms and brushes. In India, pearl millet is known as bajra, in West Africa as Guinea corn, and in China as kaoliang. Pearl millet is especially valued in hot and arid regions for its resistance to drought and heat. Pearl millet is a strong grass and usually

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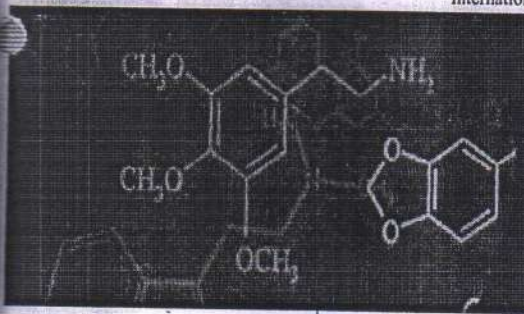

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Studies on the effect of seed biopriming based formulations in the management of bakanae (*Fusarium moniliforme*) disease of rice

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Abstract
Rice is the most important staple food for millions across the world including India. There are several diseases affecting the rice crop thereby causing great losses in the yield. Among them, rice bakanae disease is one of the serious problems especially in basmati rice growing areas like U.P, Haryana, and Punjab etc. causing yield loss up to 15% in India. *Fusarium moniliforme*, a seed and soil borne pathogen causing bakanae disease produces different kinds of symptoms like abnormal elongation of seedlings and foot rot etc. So, in the present study we conducted an experiment of seed biopriming by preparing *Trichoderma* based formulations which include different ingredients viz. Multani soil, Molasses, NPK fertilizer, Neem cake, Propiconazole in total seven different treatment combinations and one untreated control. Results from experiment proved that out of these seven different treatment combinations, The minimum disease incidence of 8.93 and 14.48% were recorded in Multani soil + *Trichoderma* + Propiconazole + Molasses whereas maximum disease incidence 26.85 and 27.14% were recorded in Multani soil + *Trichoderma* at 15 and 30 DAS respectively. The maximum plant height of 10.03 and 17.43 cm were recorded in case of Multani soil + *Trichoderma* + Molasses combination and minimum plant height of 6.60 and 12.73 cm was recorded in case of Multani soil + *Trichoderma* + Propiconazole + Molasses at 15 and 30 DAS respectively.

Keywords: Rice, plant growth parameters, bakanae disease, *Fusarium moniliforme*, disease incidence, management

Introduction
Rice (*Oryza sativa* L.) is the staple crop for more than 3 billion people around the world. Realizing the global importance, rice has shaped the diets, culture, and economy of millions of people (Anonymous, 2003) [1]. Rice is the staple food of more than 60% of the world's population. It is the staple food of most of south-east Asia. About 90% of the total rice grown in the world is produced and consumed in Asian region. Rice provides 21% of energy and 15% of the protein requirements of the population globally (Depar, *et al.*, 2011) [5]. Two major rice species *Oryza sativa indica* and *Oryza sativa japonica* are grown worldwide. Rice belongs to family Poaceae (old Gramineae). The commonly cultivated rice is an annual crop which usually grows to the height of one or two meters but some varieties grow up to 6-9 meter (Anonymous, 2006) [2]. It is grown in all continents except Antarctica and occupying about 150 mha area, producing 570 mt with an average productivity of 3.83 tones/ha. India is the second-largest producer of rice in the world after China. India ranks first in the world for the production and export of basmati rice. About 70% of basmati rice is produced in India, where, it shares 15% in hectares with a production of 35.0 lakh metric tonnes (Anonymous, 2013) [3].

In India, the area, production, and productivity of rice is 43.42 mha, 105.24 mt and 2.42 t/ha, respectively. However, Uttar Pradesh is the largest rice-growing state after West Bengal but its productivity is low. The productivity of West Bengal and UP is 2.88 and 2.13 t/ha respectively. In UP rice occupies an area of 5.86 mha, produces 14.41 mt rice with a productivity of 2.46 t/ha in UP (Anonymous, 2016) [4]. Foot rot and bakanae of rice caused by *Fusarium moniliforme* Sheldon [teleomorph: *Gibberella fujikuroi* (Sawada) Wollenweber] occurs in almost

The pathogen is primarily seed borne but also survives in soil and diseased plant debris in certain area (Ou, 19[illegible]9]. The most striking symptom of this disease is yellowing and abnormal elongation of infected rice seedling which led to the name bakanae. The other symptoms of this disease are foot rot, seedling rot, grain sterility and grain discoloration (Ou, 1985) [8, 9]. In recent years, bakanae disease has been spreading and being reported from newer parts of Asia. In China, Japan, Thailand, Pakistan, Bangladesh and Nepal bakanae has become a major disease since last decade and 10-70 percent disease incidence was recorded in basmati and improved rice cultivars. In India, bakanae disease incidence has been increasing considerably and moderate to severe yield losses ranging from 15-25 percent have been reported from Eastern U.P., Assam, Andhra Pradesh, Tamilnadu, Haryana and Punjab (Rathaiah *et al.*, 1991, Sunder *et al.*, 1998 and Pannu *et al.*, 2012) [11, 13, 10].

Materials and Methods

Various *Trichoderma* spp based formulations were tested to check the efficacy of formulations against *Fusarium moniliforme* with the help of seed biopriming technique.

Collection of *Trichoderma*: The culture of *Trichoderma* isolate was obtained from the Nematology Laboratory, Department of Plant Pathology, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, U.P.

Mass multiplication of *Trichoderma*

Wheat grains were used for mass multiplication of *Trichoderma* isolates. Wheat grains were soaked in water for 12 hours and then spread on paper to remove the extra water. Dextrose was added in wheat seeds @ 20gm/kg seed and then 250 gm of wheat grain were taken in each 500 ml conical flasks. Flasks with wheat grains were plugged with nonabsorbent cotton and wrapped with aluminum foil and sterilized in an autoclave at 121^{0}C temperature at 15 lbs pressure/inch^2 for 15 minutes. After proper cooling of the conical flask, containing sterilized wheat grains were inoculated with 5 mm diameter PDA discs punched from periphery of actively growing 5 days old culture of *Trichoderma*. All inoculated conical flasks were incubated in a BOD incubator at 26±2 °C temperature. Incubated flasks were allowed to grow *Trichoderma* with periodic shaking of the flasks so that the surfaces of all wheat seeds were colonized with thick mycelial growth of *Trichoderma* properly. After full colonization of the wheat grain by *Trichoderma*, colonized grains were takeout from the flask and air-dried in shaded conditions. The sterilized dried wheat grains were ground with the help of mechanical grinder Plate No. 01.

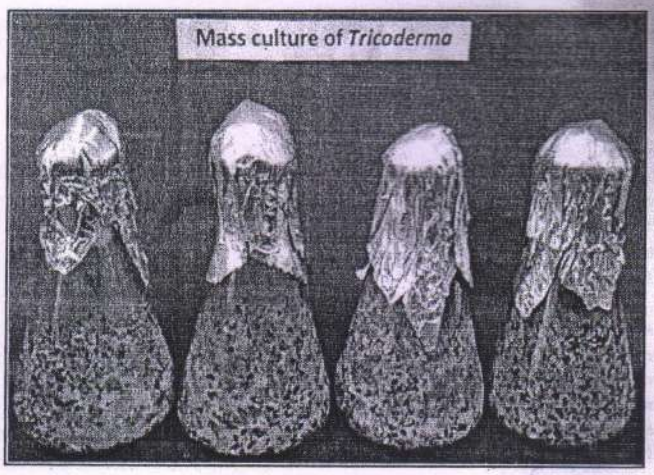

Plate 01: Mass multiplication of *Trichoderma*

Isolation and purification of pathogen

Rice plant showing typical symptoms of bakanae disease were collected from the CRC Chirori farm of the University. The collected disease specimen brought to the laboratory and critically examined and studied for the symptoms of the disease and isolation of the pathogen. Plate No. 02

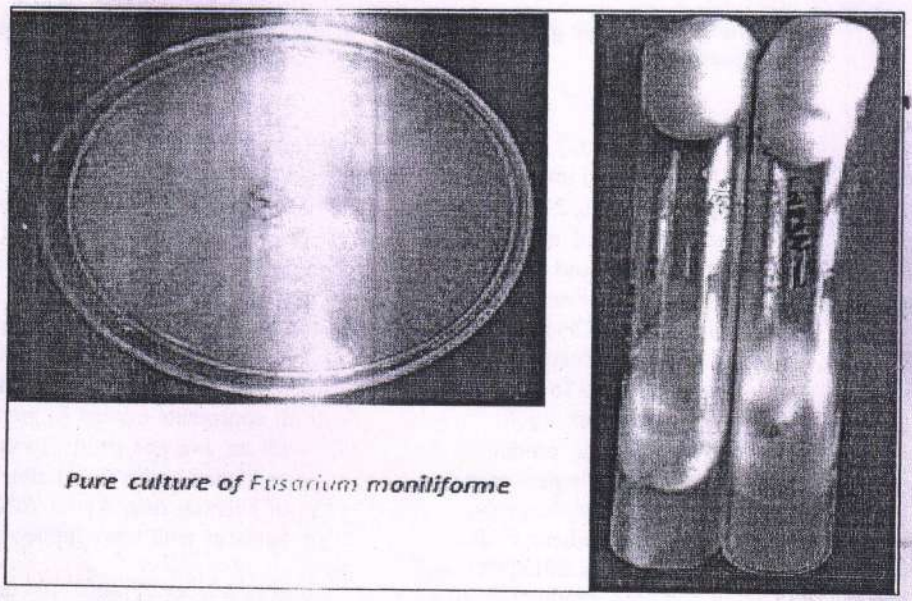

Plate 02: Purification of pathogen

Preparation of formulations: *Trichoderma* formulation was prepared by mixing different substances with *Trichoderma* wheat grain powder. The different formulation was developed [illegible] Multani soil @10 gm/kg of seed, *Trichoderma*@10 gm/kg of seed, Neem cake@10 gm/kg of seed, Propiconazole@1 ml/liter of water, Molasses@10 ml/kg of seed, and NPK@10 gm/kg of seed. Plate No 03

derma and Multani soil + *Trichoderma* + Molasses ectively. The Maximum disease incidence 26.85 and 14% was recorded in Multani soil + *Trichoderma* whereas, 4.72 and 36.11% was recorded in case of control at 15 and 30 days after sowing respectively. Sandhu *et al.* (2016) [12] Bakanae disease was recorded in all the basmati growing fields and up to 10 percent incidence was recorded on different aromatic rice cultivars. Pusa Basmati 1401 was observed more susceptible followed by Pusa Basmati 1121 and Pusa Basmati 1509. Basmati crop raised at the recommended period showed lower disease incidence than the early transplanted crop. The recommended technology to manage this disease *i.e.* seed soaking in pesticide solution containing carbendazim 50 WP @ 0.2 percent + Streptocycline 0.01 percent (one g) for 12 hrs. followed by seedling root dip in carbendazim 50 WP (0.2%) for 6 hrs.

Table 1: Effect of seed biopriming on growth parameter and bakanae disease incidence of the rice plant.

Treatment	Plant Height (cm)		Root Length (cm)	Disease Incidence (%)	
	15 DAS	30 DAS	30 DAS	15 DAS	30 DAS
T_1 - Multani soil + *Trichoderma* + Neem Cake + Propiconazole + Molasses + NPK	7.50	10.50	5.03	16.98	16.98
T_2 - Multani soil + *Trichoderma* + Propiconazole + Molasses + NPK	6.97	10.50	5.33	10.31	14.48
T_3 - Multani soil + *Trichoderma* + Propiconazole + Molasses	6.60	10.33	6.33	8.93	14.48
T_4 – Multani soil +*Trichoderma* + Molasses	10.03	17.43	7.67	23.15	24.09
T_5 - Multani soil + *Trichoderma*	9.33	16.57	7.33	26.85	27.14
T_6 - Multani soil	9.10	15.83	6.33	22.22	22.22
T_7 - Multani soil + *Trichoderma* + Propiconazole	8.0	10.33	5.33	11.57	15.28
T_8 - Control (without any treatment)	8.5	12.50	7.33	34.72	36.11
CD at 5% level	0.925	0.678	1.196	2.289	4.847

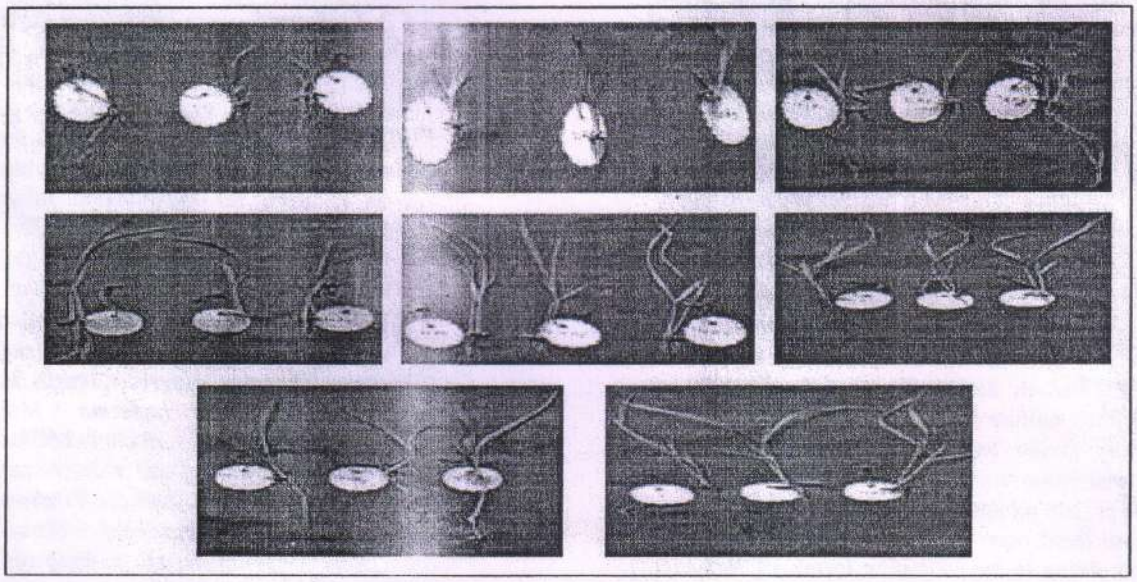

Plate 04: Effect of seed biopriming on the growth parameter of the rice plant

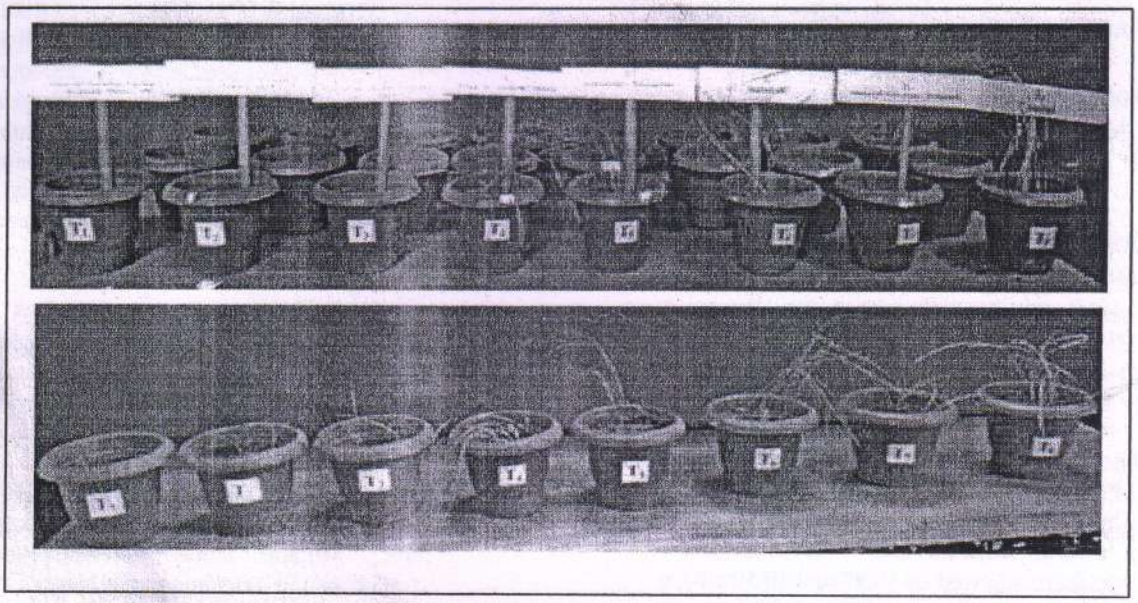

Plate 05: Effect of seed biopriming on the incidence of bakanae disease of the rice plant.

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EVALUATION OF PERFORMANCE OF BROILER CHICKEN FED WITH MAIZE GLUTEN COMPARED TO SOYA DOC WITH 3% REPLACEMENT

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ABSTRACT

An experiment was carried out by using one thousand seven hundred sixty, day old commercial broiler chicks (VenCobb 430 Strain), divided into two groups, one control and one treatment group with eight replicates of one hundred ten chicks in each. Two experimental diets were prepared, *viz.,* standard broiler ration as per BIS standards which was control ration T_0 and T_1 with 3 % maize gluten meal (67%) by replacing soya de oiled cake (DOC). Growth performance (body weight gain, feed intake and feed conversion ratio) and economics of broiler farming were evaluated. The average body weights at the end of sixth week was significantly ($P<0.05$) higher in treatment group T_1 as compared to control groupT_0. No significant differences were observed in feed consumption among all dietary treatments. Feed conversion ratio didn't differ significantly at the end of 6th week for both the groups. The cost of feed per kg live weight gain was more for T_1 group as compared to group T_0 but due to more weight gain in T_1 group the net profit fetched per bird was more in T_1 than group T_0. It can be concluded that maize gluten can be used as replacement of soya DOC in the diet of broilers

Key words : *Broiler, maize gluten, growth performance and economics*

Poultry farming offers the best prospects for rapid production of high quality protein in the form of eggs and meat. Feed is a major component in the poultry production as it constitutes 70% to 80% of the total cost of production. (1). Poultry farmers utilize different type of protein source such as fish meal, meat meal, blood meal, decorticated cotton seed meal, til cake, toria cake, guar meal, ground-nut cake, sun flower cake and soybean meal and maize gluten meal. Vegetable protein sources are available in comparatively greater quantities and can efficiently be incorporated in poultry rations. Constraints on the use of soya bean meal in poultry diets are the serious consumer concerns on the environmental impact of soybean production and use (2). The remaining sources, like cottonseed meal, sunflower meal and rapeseed meal are being used in the poultry diets with a caution due to presence of anti-nutritional factors in these ingredients (3). The ever increasing cost of conventional energy and protein sources used in poultry feed, such as maize and soybean meal, have increased the cost of poultry production. This rising cost of production in broiler chicken can be overcome by the use of maize gluten meal. Keeping in view the importance and vitality of maize gluten meal in broiler feed, the present study was therefore, carried out to determine the effect of maize gluten meal (67%) on the growth performance and economical production of broiler.

MATERIALS AND METHODS

Maize gluten is a by-product of the manufacture of maize starch by a welling process (RFA, 2008). It is a rich feed, containing about 43 to 67% crude protein (DM), depending on its grade, used as a source of protein. It is highly digestible source of plant proteins. Protein from maize gluten meal is composed mainly of zein (68%), glutelin (27%) and small amount of globulins (1.2%) (4). It is relatively rich in linoleic acid and abundant in carotenes and xanthophylls particularly made from yellow corn (5, 6). Maize gluten meal is a rich source of protein, vitamin A, Lucine and isoleucine. The present experiment was undertaken to evaluate the performance of broiler chicken fed with maize gluten compared to soya DOC with 3% replacement through assessment of growth performance (body weight gain, feed intake and feed conversion ratio) and economics of broiler farming. The maize gluten was was purchased from local market. The experiment was carried out on 1760, day-old Vencobb 430 straight run commercial broiler chicks for a period of 42 days (6 weeks) in the Dr B V Rao Institute of Poultry Management and Technology, Tilekarwadi, Urulikanchan, Pune. The chicks were obtained from M/s Venkateshwara Hatcheries PVT. LTD. Naigaon, Pune, Maharashtra. On arrival, the chicks were weighed individually and distributed randomly on equal body weight basis into two groups *viz*, treatment group T_1 and control group T_0 with eight replicates of 110 chicks in each. The total birds were allocated to different treatment groups are presented in Table-1.

Housing and management : All the pens, waterers, feeders, brooders and floor were cleaned, washed, disinfected and fumigated before arrival of broiler chicks. The birds were housed under deep litter system with rice husk and saw dust as litter material. The uniform managemental practices *viz*. feeding, watering and lighting were followed for all the groups throughout the experimental period. The experimental chicks were housed in four different pens and provided one and half square foot floor space to each chick. The birds were offered *ad-libitum* drinking water throughout the experiment. All the experimental chicks were vaccinated for Marek's and Gumboro disease vaccine.

Table-1 : Experimental details.

Sr. No.	Treatment group	Treatment details	Replicates	No. of birds in each replicate	Average body weight (g)
1.	T_0	Standard broiler ration	8	110	46.5 ± 0.29
2.	T_1	3% Maize gluten (replacement of Soya DOC)	8	110	46.10 ± 0.19

Table-2 : Per cent composition of experimental rations.

Sl. No	Ingredients	Prestarter %		Starter %		Finisher %	
		T_0	T_1	T_0	T_1	T_0	T_1
1.	Maize	53.730	55.530	56.670	58.905	60.050	62.295
2.	Soya DOC	37.400	33.500	33.770	29.500	29.780	25.500
3.	Maize Gluten	0.000	3.000	0.000	3.000	0.000	3.000
4.	Lime Stone Powder.	0.970	1.000	1.100	1.120	1.100	1.150
5.	Di Calcium Phosphate	1.150	1.150	0.950	0.950	0.830	0.830
6.	Soya Refined Oil	2.690	1.800	3.835	2.800	4.775	3.750
7.	L-Lysine	0.230	0.320	0.190	0.280	0.180	0.270
8.	DL-Methionine	0.340	0.310	0.280	0.250	0.260	0.220
9.	L-Threonine	0.100	0.100	0.030	0.030	0.090	0.100
10.	Vitamin Premix	0.050	0.050	0.050	0.050	0.050	0.050
11.	Mineral Premix	0.100	0.100	0.100	0.100	0.100	0.100
12.	Liver tonic	0.025	0.025	0.025	0.025	0.025	0.025
13.	Coccidiostat	0.100	0.100	0.100	0.100	0.100	0.100
14.	Toxin binder	0.100	0.100	0.100	0.100	0.100	0.100
15.	Optiphos DS	0.010	0.010	0.010	0.010	0.010	0.010
16.	Citric Acid	0.030	0.030	0.030	0.030	0.030	0.030
17.	Soda Premix	1.200	1.200	1.100	1.100	0.900	0.900
18.	Salt Premix	1.100	1.000	1.000	1.000	1.000	0.950
19.	Choline Chloride Premix	0.675	0.675	0.660	0.650	0.620	0.620
	Total	100.000	100.000	100.000	100.000	100.000	100.000

All the broiler chicks were fed with ground maize for first two days of age followed by the experimental ration prepared as per (7) standards up to 42nd day of age. The diets were fed *ad-libitum* to all groups. Maize gluten was added in ration @ 3% replacement to Soya DOC in T_1 treatment group at the time of feed preparation. Weighed amount of ration was offered every day to the entire treatment groups.

Observations recorded : The live body weights of all birds were recorded at weekly interval. From these data, the average weekly body weight and weight gain per bird were calculated for various treatment groups. The average feed consumption was calculated from the total feed offered minus left over feed on the next day morning. Feed conversion ratio (FCR) was calculated by dividing the feed consumption by weight gain. The chemical analysis of the experimental broiler rations were carried out as per (8) for all the proximate principles. The data collected during this investigation were subjected to statistical analysis by Complete Randomized Design (CRD) method with week and treatment as two factor as per (9).

RESULTS AND DISCUSSION

Analyzed composition of experimental ration is given in Table-3. It may be observed from values in Table-3 that experimental ration contained adequate nutrients for growth as per (7) for broilers.

Weight gain : At the end of sixth week T_1 group gained significantly ($P<0.05$) higher body weight (2480.12 g) as compared to T_0 group (2409.62 g). The results obtained in this experiment are in concurrence with the findings of (10, 11, 12) who reported significant ($P<0.05$) improvement in body weight gain in broilers. However, contradictory results were observed by (2) who reported that the body weight values of maize gluten meal group were significantly lower than control. (3) observed no any significant effect on body weight.

Table-3 : Per cent chemical composition of ration on dry matter basis.

Nutrients Per cent in ration	Prestarter ration		Starter ration			
	T_0 (control)	T_1	T_0 (control)	T_1	T_0 (control)	T_1
Crude protein	22.56	22.99	21.03	21.33	19.50	19.79
Crude fiber	4.07	3.89	3.93	3.74	3.76	3.57
Ether extract	5.21	4.35	6.42	5.43	7.44	6.47
Acid insoluble ash	0.90	0.85	0.85	0.80	0.79	0.74
Calcium	0.94	0.94	0.93	0.92	0.88	0.89
Phosphorus	0.46	0.46	0.42	0.42	0.39	0.39
ME Kcal/kg	3011.11	3009.20	3113.53	3106.71	3213.03	3205.90

Table-4 : Mean values for parameters of economic importance of broiler as influenced by maize gluten meal (67%).

Groups	Feed Consumption	Weight gain	FCR	Mortality	Net profit
	(g)	(g)			Rs/bird
T_0	4046.75	2409.62	1.69	2.84	15.01
T_1	4145.25	2480.12	1.67	3.07	18.47
SE	32.23	21.93	0.00		
CD	NS	68.09	NS		

NS = Non significant

Feed consumption : The feed consumption of experimental broiler chicks was recorded at weekly interval throughout experimental period of six weeks. The average weekly feed consumption of broiler chicks is presented in Table-4. Weekly feed consumption per bird at the end of sixth week didn't differ significantly among treatment and control group. The birds in T_1 group consumed significantly ($P<0.05$) higher feed as compared to T_0 group. It is obvious from result that 3% maize gluten in replacement of Soya DOC proved to be an no much difference in feed consumption. The results of present study could be correlated with the results of (2, 12) who reported that the feed intake did not differ among treatment groups. However, contradictory results were observed by (11) who also experienced that maize gluten meal supplementation to a certain level caused decrease in feed consumption.

Feed conversion ratio : Feed conversion ratio during 0 to 6 week were calculated from the data of average weekly body weight gain and weekly feed consumption and presented in Table-4. The means at the end of 6^{th} week for treatment T_0 (1.69) and T_1 (1.67) didn't differ significantly. The results of present study could be correlated with the results of (2, 13) who observed that FCR values did not differ significantly among the experiment groups. However, contradictory results were obtained by (14, 15) who observed positive effect of maize gluten meal supplementation and reported that feed efficiency improved significantly with increasing maize gluten meal to a certain proportion.

There was no adverse effect of maize gluten meal on the mortality of broilers, which shows that maize gluten meal is a safer supplement for broiler ration so far the mortality is concerned. These results have been fully supported by earlier workers like, (12, 14, 15) who also found that broiler fed on ration contained maize gluten meal had no effect on mortality rate of broilers.

Economics : The cost of feed was Rs.100.06 and 100.96 in groups T_0 and T_1 respectively; while the total cost per bird was Rs. 133.76 and 134.66 in groups T_0 and T_1 respectively. Against above production cost per chick, the total income per chick achieved was Rs. 148.77 and 153.12 in groups T_0 and T_1 respectively. Thus, the net profit per bird received was Rs. 6.23 and 7.45 in groups T_0 and T_1 respectively. So, in this investigation group T_1 proved to be most economical and profitable for broiler production. It was concluded that inclusion of three per cent maize gluten meal instead of Soya DOC for broiler ration proved to be an efficient feed ingredient for optimum growth, FCR and better net profits for farmers.

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Studies on Genetic Variability, Character Association and Path Analysis in Blackgram (*Vigna mungo* L. Hepper) Varieties

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ABSTRACT

The present investigation was conducted during *Kharif* 2017 in crop cafeteria at Krishi Vigyan Kendra, Bilari, Moradabad to examine 12 released varieties for genetic variability, correlation and path analyses towards grain yield in black gram. The experiment was laid out in Randomized Block Design with three replications. ANOVA showed highly significant differences among all the 12 genotypes for all the eight attributes under studied. High genotypic and phenotypic coefficient variations were recorded for number of pods per plant, grain yield per plant and number of primary branches per plant. High heritability (bs) was recorded for all the characters except days to maturity while high genetic advance in per cent of mean for all the characters except days to maturity and plant height. Strong positive association of grain yield per plant observed for all the characters except days to maturity. Direct and positive effect on grain yield was recorded for number of pods per plant, number of primary branches per plant and harvest index.

Keywords *genetic variability, correlation, path, heritability, genetic advance.*

The pulses are second most important group of crops after cereals, globally. Black gram is a short duration crop widely cultivated in India which is an excellent source of easily digestible good quality protein and ability to restore the fertility of soil through symbiotic nitrogen fixation. The major constrains in achieving higher yield of black gram are lack of genetic variability, suitable varieties and genotypes with adaptation to local condition. Grain yield is considered as an end product and very complex character which controlled by poly genes and linked with other yield component, hence, it is, very difficult to improve yield directly. Due to high self-pollination and flower droop, the creation of variability is difficult through hybridization (Deepalakshmi and Anandakumar, 2004). The major constrains in achieving higher yield of black gram is absence of suitable ideotypes for different cropping system, poor harvest index and susceptibility to disease (Souframanien and Gopalakrishnan, 2004). To improve yield and other polygenic characters, genetic variability is basic requirement for breeding programme (Appalaswamy and Reddy, 2004). In India, black gram is grown in both season *Kharif* and *Zaid*. So the variability among the existing varieties is the primary need to develop suitable genotype for specific season. A successful breeding programme would need information on the nature and variability in the available genetic stock for choosing the right parents for further improvement (Falconer, 1981).

MATERIALS AND METHODS

The experimental material for the present investigation consisted of 12 released varieties *viz.*, TU 94-2, SHEKHAR 3, KUG 791, LBG 787, IPU 94-1, LBG 645, LBG 623, LBG 752, KU 96-3, IPU 2-43, NUL 7 and PU 31 collected from Indian Institute of Pulses Research, Kanpur. The experiment was conducted in Randomized Block Design in crop cafeteria at Krishi Vigyan Kendra, Bilari, Moradabad during *Kharif* 2017. Recommended cultural practices were followed to raise healthy crop. Ten plants from each genotype were randomly selected for recording observations on eight characters viz., days to maturity, plant height (cm), number of primary branches per plant, number of pods per plant, biological yield (g), grain yield per plant (g), 1000-grain weight (g) and harvest index (%). Analysis of variance was carried out as per standard procedure (Fisher, 1938). Genotypic and phenotypic coefficient of variation (GCV and PCV) was calculated according to Burton and de Vane, 1953. Broad sense heritability and genetic advance as per Hanson 1963 and Robinson *et al.*, 1949, while correlation and path analyses worked out as the method Searle, 1961 and Deway and Lu, 1969, respectively.

RESULTS AND DISCUSSION

ANOVA for all the characters revealed significant differences among all the genotypes for eight characters under study (Table 1), indicated that there is ample scope to utilized these genotypes for further breeding programmes. Phenotypic coefficient variation was higher than genotypic coefficient of variation for all the characters thus indicating influence of environmental/ genotype environment interaction effects on these characters. The GCV and PCV maximum for number of pods per plant (29.68, 27.91), grain yield per plant (27.28, 26.31) and number of primary branches per plant (27.10, 23.23). Moderate PCV and GCV were recorded for harvest index, biological yield per plant and 1000-grain weight while rest two characters showed low values (Table 2). Therefore, suggested that greater scope of selection for number of pods per plant, grain yield per plant and number of primary branches per plant while harvest index, biological yield per plant and 1000-grain weight indicated chances of obtaining some improvement through selection. Low estimate of PCV and GCV for rest two attributes revealed little scope of improvement in these traits through selection. These findings are accordance with earlier report of Konda *et al.*, 2009; Samad *et al.*, 2013.

Heritability (bs) include additive and epistatic effects, it is realized only when accompanied with genetic advance. It is also suggested that GCV with high heritability estimates give the best picture of extent of genetic advance for

Table 1. Analysis of variance for 8 different quantitative characters in 12 varieties of blackgram

Sl. No.	Characters	Mean Sum of Squares		
		Replication (d. f. = 02)	Treatments (d. f. = 11)	Error (d. f. = 22)
1.	Days to maturity	7.58	49.75***	7.43
2.	Plant height (cm)	5.62	30.12***	2.72
3.	No. of primary branches per plant	0.44	4.14***	0.44
4.	Number of pods per plant	4.7	171.24***	7.17
5.	Biological yield per plant (g)	0.15	13.02***	1.41
6.	Grain yield per plant (g)	0.19	6.28***	0.15
7.	1000-grain weight (g)	2.13	76.35***	1.40
8.	Harvest index	9.44	128.02***	3.72

Table 2. Genetic parameters for 8 biometrical characters of 12 varieties of blackgram

Sl. No.	Characters	Range	Mean	Vg	Vp	GCV	PCV	h^2(bs) %	GA	GA % of mean
1.	Days to maturity	71.33-85.66	75.33	14.11	21.54	4.99	6.16	65.50	6.26	8.31
2.	Plant height (cm)	39.50-50.00	43.64	9.20	11.93	6.95	7.91	77.12	5.49	12.57
3.	No. of primary branches per plant	3.33-6.33	4.78	1.23	1.68	23.23	27.10	73.49	1.96	41.03
4.	Number of pods per plant	17.66-36.00	26.50	54.69	61.86	27.91	29.68	88.40	14.32	54.05
5.	Biological yield per plant (g)	11.16-19.47	15.94	3.87	5.28	12.34	14.42	73.23	3.47	21.76
6.	Grain yield per plant (g)	3.40-7.47	5.43	2.04	2.20	26.31	27.28	93.02	2.84	52.27
7.	1000-grain weight (g)	35.73-52.20	43.60	4.99	26.39	11.46	11.78	95.69	10.02	22.98
8.	Harvest index	24.72-42.93	33.86	41.44	45.16	19.01	19.84	92.76	12.70	37.51

Table 3. Estimates of phenotypic (upper diagonal) and genotypic (lower diagonal) correlation coefficients between 8 characters of blackgram

Characters	Days to maturity	Plant height (cm)	No. of primary branches per plant	Number of pods per plant	Biological yield per plant (g)	1000-grain weight (g)	Harvest index	Grain yield/ plant (g)
Days to maturity	**1.000**	0.1587	0.2051	0.3619*	0.4851**	0.1247	0.1584	0.3861*
Plant height (cm)	0.3156	**1.000**	0.4201*	0.4966**	0.3522*	0.0983	0.4449**	0.5215**
No. of primary branches per plant	0.4554	0.4448	**1.000**	0.8351***	0.3879*	0.6088***	0.8041***	0.7942***
Number of pods per plant	0.4391	0.5942	0.9831	**1.000**	0.5439***	0.5597***	0.8638***	0.9151***
Biological yield per plant (g)	0.5845	0.5218	0.6573	0.6027	**1.000**	0.4204*	0.2633	0.7133***
1000-grain weight (g)	0.1633	0.1364	0.7649	0.6411	0.4938	**1.000**	0.5997***	0.6551***
Harvest index	0.2533	0.5451	0.9461	0.9910	0.3955	0.6569	**1.000**	0.8614***
Grain yield per plant (g)	0.4748	0.6482	0.9458	0.9367	0.7470	0.7022	0.9042	**1.000**

*,** Significant at 5% and 1% probability level, respectively

selection of such character. Present investigation showed high GCV, heritability (bs) and genetic advance for number of pods per plant, grain yield per plant and number of primary branches per plant and these character would be improve through selection in black gram (Table 2). The result were in agreement with Jonson *et al.* (1995); Konda *et al.* (2009); Sowmini and Jayamani (2013); Wani *et al.* (2007).

The present investigation showed that grain yield per plant exhibited highly significant and positive phenotypic correlation with all the characters except days to maturity. Thus, number of pods per plant, harvest index and number of primary branches per plant emerged as most

Table 4. Direct (Bold diagonal figures) and indirect effects of different characters on grain yield per plant at genotypic level in blackgram

Characters	Days to maturity	Plant height (cm)	No. of primary branches per plant	Number of pods per plant	Biological yield per plant (g)	1000-grain weight (g)	Harvest index
Days to maturity	**0.0689**	0.0218	0.0314	0.0303	0.0403	0.0113	0.0175
Plant height (cm)	-0.0203	**-0.0642**	-0.0286	-0.0381	-0.0335	-0.0088	-0.0350
No. of primary branches per plant	-0.1312	-0.1282	**-0.2882**	-0.2969	-0.1894	-0.2204	-0.2726
Number of pods per plant	-0.0488	-0.0660	-0.1145	**-0.1111**	-0.0670	-0.0712	-0.1101
Biological yield per plant (g)	0.3327	0.2970	0.3742	0.3430	**0.5692**	0.2811	0.2251
1000-grain weight (g)	0.0004	0.0003	0.0016	0.0014	0.0011	**0.0021**	0.0014
Harvest index	0.2731	0.5875	1.0198	1.0682	0.4263	0.7081	**1.0779**
Grain yield per plant (g)	0.4748	0.6482	0.9958	0.9967	0.7470	0.7022	0.9042

Residual Effect = 0.0728

Table 5. Direct (Bold diagonal figures) and indirect effects of different characters on grain yield per plant at phenotypic level in blackgram

Characters	Days to maturity	Plant height (cm)	No. of primary branches per plant	Number of pods per plant	Biological yield per plant (g)	1000-grain weight (g)	Harvest index
Days to maturity	**0.0250**	0.0040	0.0051	0.0090	0.0121	0.0031	0.0040
Plant height (cm)	0.0040	**0.0252**	0.0106	0.0125	0.0089	0.0025	0.0112
No. of primary branches per plant	0.0044	0.0090	**0.0215**	0.0179	0.0083	0.0131	0.0173
Number of pods per plant	0.0047	0.0064	0.0108	**0.0129**	0.0070	0.0072	0.0111
Biological yield per plant (g)	0.2385	0.1732	0.1907	0.2675	**0.4917**	0.2067	0.1295
1000-grain weight (g)	0.0019	0.0015	0.0092	0.0085	0.0064	**0.0151**	0.0091
Harvest index	0.1076	0.3022	0.5462	0.5867	0.1788	0.4074	**0.6793**
Grain yield per plant (g)	**0.3861**	**0.5215**	**0.7942**	**0.9151**	**0.7133**	**0.6551**	**0.8614**

Residual Effect = 0.0504

important and strongly associated with grain yield (Table 3). At the genotypic level (Table 3) for these characters were same direction but higher in magnitude with grain yield indicated that these characters could be helpful for improvement of grain yield per plant through improving these characters. Direct effects revealed that number of pods per plant, number of primary branches per plant and harvest index exerted very high positive direct effects on grain yield per plant at phenotypic as well as genotypic level showed in Table 4 and 5, respectively. Thus, these three attributes emerged as most important direct yield components. So selection through these traits would be effective for grain yield. The direct effects of the remaining characters were to be considered important**.** The observation is agreement of earlier workers Chauhan *et al.* (2007); Gupta *et al.* (2005); Umadevi and Ganesan (2006).

Breeding strategies

The present investigation showed ample genetic variability available for yield and its component related traits. Number of pods per plant, harvest index and number of primary branches per plant emerged as most important and strongly associated with grain yield per plant. At genotypic level the correlation coefficient for these characters was same in direction but higher in magnitude with grain yield indicated that these characters could be helpful for improvement of grain yield/plant through improving these characters. Number of pods per plant, number of primary branches per plant and harvest index emerged as most important direct yield components. So selection through these traits would be effective for grain yield and these varieties could be further exploit for improving grain yield per plant in breeding programme on the basis of *per se* performance.

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A COMPARATIVE ANALYSIS OF HOMOLOGY MODELING OF CYTOCHROME B5 (CB5) PROTEIN OF FOXTAIL MILLET (SETARIA ITALICA)

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ABSTRACT:

The structure of a protein is very important to predict the protein's function. Computational approaches have shown substantial accomplishment in research methodologies to resolve biological problems. In this study Cytochrome b5 (CB5) protein of Foxtail millet was selected for in silico modeling of its 3D structure as its experimental structure is not available yet. Physico-chemical characterization was performed by computing theoretical molecular weight (MW), total number of positive(+R) and negative (-R) residues, isoelectric point (pI), extinction coefficient (EC), instability index (II), aliphatic index (AI) and GRAVY. SOSUI and CYS-REC servers were used for functional analysis of the protein CB5. Random coils dominated among secondary structure elements as revealed by SOPMA analysis. The modelling of the three dimensional structure of the protein was performed by using two automated homology programs, SWISS model and Geno 3D. Structure Modeled using Geno 3D showed good results in comparison to those produced using SWISS- Model. Out of all four structures predicted, the model generated by Geno 3D was most acceptable. The quality of models were validated using protein structure checking tools PROCHECK. The computationally obtained structure will provide a strong foundation for functional analysis of experimentally derived crystal structures. The postulations made in this model may be confirmed experimentally using X ray crystallography or Nuclear magnetic resonance spectroscopy for better understanding of the molecular structure and function of CB5 protein of Foxtail

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PREVELANCE OF *STAPHYLOCOCCUS EPIDERMIDIS* IN HUMAN PYOGENIC CASES IN AND AROUND MATHURA

730

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ABSTRACT

Staphylococcus spp. iscommonly found associated with pyogenic cases of skin and soft tissues. *Staphylococcus epidermidis* are one of those many pyogenic species of Genus *Staphylococcus.* It is a Gram-positive bacteriumresponsible for nosocomial infection. In recent time, it is reported to produce drug resistant strains and involved in transfer of drug resistance genes to its co-habitat. There are scanty reports on the prevalence of *Staphylococcus epidermidis* in country so the present study was designed to establish the prevalence of *Staphylococcus epidermidis* in human pyogenic cases irrespective of age and sex. The pus samples were collected from the tertiary hospitals with the help of sterile swabs and subject to isolation of bacteria as per standard protocols. Isolated bacteria were characterized based on cultural, morphological and biochemical characters. All the isolates are further processed for the molecular characterization by PCR based amplification of 16S rRNA gene and amplification of 124 bp amplicons confirmed the isolate as *S.epidermidis.* Out of 200 pus samples, 150 samples revealed the isolates with characteristics of *Staphylococcus species.* On PCR based amplification, out of 150 isolates, only 20 isolates produced characteristic 124bp band of *Staphylococcus epidermidis.* The study revealed 75% prevalence of *Staphylococcus species* in the human pus samples. However, the overall prevalence of *Staphylococcus epidermidis* is found 10.00%. It seems to be first report on the prevalence of *Staphylococcus epidermidis* in human pyogenic cases in India.

Key words : *Prevalence, Staphylococcus epidermidis, human, pyogenic cases.*

Staphylococcus is Gram-positive cocci shape andon morphological examination appears in characteristic grapes like clusters. They belong to Micrococcacea family and genus Staphylococcus. Out of several species of the genus Staphylococcus, like *Staphylococcus epidermidis,* colonize on skin and mucus membrane of human as well as animal (1). This species is mainly known for its nosocomial infections originated from hospital environments. The major virulence attribute of *Staphylococcus epidermidis,* is its capability of producing adhesion factors that helps to stick over the skin surfaces and soft tissues (2). *Staphylococcus epidermidis* is the most common cause of infectious generated from hospital equipments like peritoneal and vascular catheters, cerebrospinal shunts, vascular grafts, and prosthetic joints etc. (3). The acquisition of *Staphylococcus epidermidis* infection, mostly occur accidently during hospitalization or during surgical interventions through contaminated instruments. It is an example of turning commensalism into infection (2). The biofilm or adhesion producing capability of *Staphylococcus epidermidis* further attribute to its virulence and help in establishment of infection. Moreover, the formation of biofilm provide resistance against many of the commonly used antibacterial drugs, making its cure difficult (2). Simultaneously, it has been reported as a reservoir of several antimicrobial resistant genes such as mecA genes. These genes are integrated into the genome of the Staphylococcal cassette chromosome mec (SSCmec) leading to resistance against to methicillin and other α-lactam group of antibiotics like penicillin, ampicillin, amoxicillin, Oxacillin etc (4). *Staph. epidermidis* has been reported as major pathogen in the cases of cattle mastitis (5). The involvement of *Staph. epidermidis* in both human and animals point towards its zoonotic importance. The published reports also indicate a high level of diversity in isolates recovered from livestock, farmers and hospital-setting and involvement of similar clones in humans as well as in animals (6). The available literature revealed limited information on epidemiology of *Staph. epidermidis* in India. Considering all these, the present study was designed with the objective to know *Staph.epidermidis* prevalence in the pyogenic clinical cases of humans in and around Mathura.

MATERIALS AND METHODS

Sample collection : A total of 200 pus samples were collected from pyogenic clinical cases of human and animals irrespective of age and sex. All the samples were collected with the help of single use sterile swabs and rushed to laboratory on ice.

Isolation of *Staphylococcus epidermidis* : The swabs were brought to room temperature and transferred into 3 ml nutrient broth medium (Hi media, Mumbai) and incubated at 37°C for overnight. After overnight, 100 µl of

ient broth culture was spread over nutrient agar plates nd further incubated 37°C for overnight. The isolated colonies were further characterized based on previously described procedures (Quinn et al., 2002).

Molecular confirmation of *Staphylococcus epidermidis* : The bacterial isolates suggestive of *Staphylococcusepidermidis*based on cultural, morphological and biochemical tests were subject to molecular confirmation with previously designed species specific primers (7). The single colony was inoculated in 3 ml nutrient broth and incubated at 37°C for 6 hrs. The 6 hours growth was centrifuges at 3000 rpm for 5 min and pellet was washed twice with PBS (pH 7.4) and subject to genomic DNA isolation by phenol chloroform method (8).

The isolated genomic DNA was subject to PCR with custom synthesized species specific primers (F- 5-ATC AAA AAG TTG GCG AAC CTT TTC A-3 and R- 5-CAA AAG AGC GTG GAG AAA AGT ATC A-3) (Martineau et al.,1996). In brief, 25µl reaction mixture was prepared using 2x Emerald Amp® MAX HSPCR Master Mix (Takara Bio Inc., Japan), 225.6 pmol/µl of both forward and reverse primer, 3 µl of genomic DNA template and Nuclease free water to make up the final volume. The PCR was performed in TC-5000 thermo cycler (Techne, UK) with initial denaturation at 94 ºC for 3 min followed by 35 cycles including denaturation at 95 ºC for 1 sec, annealing at 55 ºC for 30 sec and primer extension at 72 ºC for30 sec. The final extension was done at 72 ºC for 3 min. After completion of PCR the amplified products were analyses by electrophoresis in 1.5% agarose gel containing ethidium bromide under UV rays using Gel Documentation System (Uvitec, Cambridge, UK).

RESULTS AND DISCUSSION

Due to its morphological and cultural similarity other Staphylococcal pathogens, it mostly remains overlooked. The ability of adhesion production in both solid and liquid media makes it more difficult to separate and get isolated. Most of the time bacterial colonies remain adhered with other predominating Staphylococcal bacteria like *Staphylococcus aureus* and characteristic large, entire, golden color of *Staphylococcus aureus* appears prominent over medium size, round white to creamy white color of *Staphylococcus epidermidis* leading to misinterpretation of cultural characters (9). A single colony isolated from the nutrient agar plate was streaked on the Mannitol Salt Agar and incubated for 18 hours in aerobic conditions at 37° C. No change in the color of the mannitol salt agar media due to lack of mannitol fermentation, ruled out the possibility of *Staph. aureus*. Further examination through microscope could not differentiate between these species due to similar color, arrangement and negotiable size. However, Grams staining revealed violet color cocci arranged in the form of grapes like bunches.

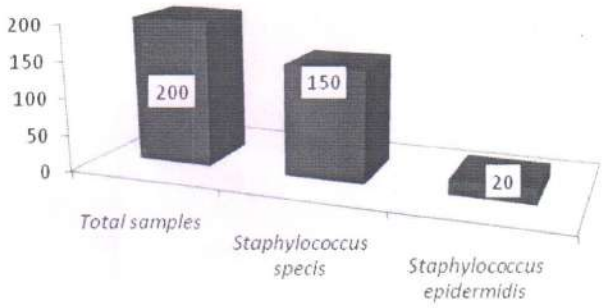
Similarly, lacks of specific differentiating biochemical tests make it more difficult to confirm *Staphylococcus epidermidis*. However, isolates were subject to catalase test to differentiate from Streptococcus and Enterococcus (10). The catalase positive culture was separated for further processing and subject to PCR based amplification with custom synthesized pre published primers for species specific amplification from16S rRNA gene (7). The isolates revealed 124 bp amplicons (Fig-1) were considered *Staph.epidermidis*.

Out of 200 samples 150 samples revealed *Staphylococcus spp.* with prevalence rate of 75% (Fig.-2). It is very high rate of prevalence. The previously published reports of similar region revealed lower prevalence (11). The prevalence may vary from season to season and also the age and sex of individuals. The old age people and kids are more susceptible to skin infections due to lower immunity levels. Thus sample biasness may affect the overall prevalence of *Staph spp.*

The PCR based amplification led to confirmation of *Staph. epidermidis*. Out of 200 pus samples only20 isolates found positive by species specific PCR of *Staph. epidermidis* (Fig-2). The overall prevalence of *Staph. epidermidis* in the human pus samples is 10.00%.It is lower than the previous published reports (12) studied 184 neonates and reported 29.8 to 58.3% prevalence of *Staph.epidermidis* in different disease conditions including blood stream infections. The neonates are more exposed to hospital environment and surgical instruments so higher chances of acquiring nosocomial infections might be the reason for the higher prevalence rates. Further, (13) observed 77% prevalence of coagulase negative *Staph.epidermidis* in the cases of hip and kneearthroplasty. Similarly, higher prevalence of 365 and 49% was reported in UK from the post surgery cases of hip and total knee arthroplasty (12). The source of sample in present study included majority of adults suffering from skin and wound ailments. The data available and its comparison with present study reconfirmed that *Staph. epidermidis* is mainly hospital acquired infection and mostly appear after hospitalization or exposure of improperly sterilized instruments due to its ability of adhesion production.

Staph. epidermidis has been ranked as third most common infective agent in native (NVIE) and first in prosthetic valve infective endocarditis (PVIE) (14). In recent reports, it has been reported in infections following artificial intraocular lens implantation due to cataract disease (15). *Staph. epidermidis* is reported to rank first following to *Staphylococcus aureus* in commensal infections and major cause of infections of medical

Fig -2 : Over all prevalence of *Staph. epidermidis*



implants and nosocomial infections throughout world especially in third world and developing countries (16). Thus, the continuous monitoring of *Staph. epidermidis* should be adopted and made an integral part of continuous monitoring programme.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Introduction

Mastitis is one of the most significant disease in dairy cows. The manifestations of mastitis include various abnormalities such as a watery appearance of milk, flakes, clots, or pus in milk. The incredible dominant cases are caused by bacteria, yet recently there have been an increasing number of reports of mycotic etiology (Spanamberg *et al*., 2008). In spite of the fact that frequency of mastitis because of fungi and yeasts is normally low in dairy herds, sometimes they have been associated with clinical mastitis in dairy cattle (Costa *et al*., 1993). *Candida* species are the most frequent organism among the mycotic mastitis agents isolated from infected glands (Watts, 1988). There are many predisposing factors that may add to the continuous increase in the prevalence of bovine mycotic mastitis as generally hot climate, predominant small-scale and household rearing systems of cattle that usually associated with unsanitary milking practices, the excessive and abuse of antibiotic treatment, the misdiagnosis and consequent delay of specific antifungal therapy. This study explore the yeast in the milk of dairy cows.

Material and Methods

Collection of Milk Samples

Milk sample was collected aseptically in sterile vials from the case at Veterinary Clinical Complex, College of Veterinary and Animal Sciences, Meerut. The udder was thoroughly washed with the potassium permanganate solution (1:1000) and wiped with clean cloth to allow dry and the teats were mopped with 70% ethyl alcohol.

Media Reagents and Chemicals

The media and chemicals were obtained from Hi-media, Mumbai (India) and prepared in the laboratory as per the standard procedures (Cruickshank *et al*., 1975).

Isolation and Identification of Isolates

Milk sample directly inoculated on Brain Heart Infusion Agar (BHI), Mac Conkeys Lactose Agar (MLA) and Sabouraud Dextrose Agar (SDA) plates for microbial isolation. The inoculated plates were incubated aerobically at 37°C for 24-48 hrs for bacterial isolation and 25°C for one week for fungal isolation. The typical colonies were subjected to various microbiological tests methods as per described by Quinn *et al*. (2004).

In-vitro Antifungal Susceptibility Testing

All the microbial isolated were analyzed for five different antifungal discs (M/s Hi Media Laboratories Ltd., Mumbai, India) namely–Ketaconazole (50 mcg), Fluconazole (25 mcg), Clo-trimazole (10 mcg), Itraconazole (10 mcg), Polymixin-B (300 mcg). The disc diffusion method of Bauer *et al*. (1966) was employed and the interpretation was made as per the zone size interpretation chart provided by the manufacturer of discs.

Result and Discussion

Mastitis influence the milch animals and inflicting huge financial losses to the dairy sector throughout the world (Pal, 2007). The milk sample yielded pure and heavy growth of yeast on Sabouraud dextrose agar (SDA) at 37◦C within 24–48 h. Colonies are opaque, white and usually smooth with creamy texture or pasty, and microscopically it seems to comprise solely of oval to round budding blastospores. This was in the accordance with the finding of Jadhav and Pal (2013) who reported *Candida albicans* from milk of buffalo and cattle. The *in-vitro* antifungal investigation revealed Polymyxin B to be the most effective drug. The treatment of the mycotic fungi is a venture, as most of the fungi don't respond any antibiotic therapy (Tarfarosh and Purohit, 2008). Candida is typically viewed as an opportunistic yeast pathogen, and the source of contamination may be skin of the udder, milker's hands, milking machines, floors, straw, feed, medications, sanitary agents and other equipment (Krukowski *et al*., 2006). Kitamura *et al*. (1990) reported pseudohyphae, blastoconidiae, and hyphae in the mammary tissue and infiltration and granulation tissue in chronic mastitis due to *Candida maltosa* in a cow. The isolation and identification of *C. albicans* from mastic milk demonstrated that yeast was likely the etiological agent of mastitis in this case. Our investigation likewise supported by the finding of Pal (2015) who reported first time *Candida* species from the she camel in Ethopia. Extensive indiscriminate application of antibiotics for the treatment of mastitis may lead to

development of fungi in the under.

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Conflict of Interests

There is no conflict of interest.

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938 - 207

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Case Report

Isolation of Candida Spp. from Mastitis Milk

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Abstract

Crossbred cattle (Jersey x Sahiwal), eight year of age was suffering from a clinical mastitis. It was treated with cephalosporin according to antibiotic sensitivity test. The Candida species was isolated in pure form and it was subjected to five antifungal drugs viz: Ketaconazole, Fluconazole, Clotrimazole, Itraconazole and Polymixin-B. The Polymyxin B was the best effective drug against candida mastitis. Indiscriminate utilization of antibiotics without knowing the cause of infection could be a reason behind the candida mastitis.

Keywords: Antifungal, Candida, Mastitic

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Impact of CFLD on Production and productivity blackgram (Urd)

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Abstract

Pulses are rich source of protein and can play vital role in fulfilling the rquirement of swiftly increasing population. India is the world's first largest producer (25%) and consumer (27%) of pulses and importer (14%) of pulses in the world. It was for the first time since plan intervention on pulses that nation inscribed a success by achieving higher production at 23.13 Mt and 25.23 Mt during 2016-17 and 2017-18. Major increment was recorded in kharif production i.e. 62 per cent mainly due to lion share contributed by urd (82 per cent) followed by tur (52 per cent) and mung (34 per cent). Over all maxium number of farmers fall in category of poor level kowledge, while very fiew with high knowledge level. The average yield recommended practice (CFLD) was obtained 13.66 q/ha as compared to farmers' practice 7.03 q/ha, which was 94.44 per cent higher than farmers' practice. Technology gap is the gap in the demonstration yield over potential yield was found 0.34 q/ha while extension gap was recorded 6.64 q/ha. Technology index I (1.43-3.43). The two years average yield of CFLD demonstration technology I was found 2.43 per cent. Technology Index II of CFLD black gram was found higher (48.57) over farmers' practice. Cultivation of black gram under improved technologies gave higher net return 41400 & 47120 Rs/ha compared to 13050 & 16040 Rs/ha under farmers' practice in the corresponding years. The average benefit cost ratio of CFLD demo was 2.65, and that of farmers' practice 1.66.

Key Word: Black gram, production, productivity and area

Introduction

India foodgrain production to hit a record high 291.95 million tonnes in 2019-20. Total pulse production during 2019-20 is estimated at 23.02 million tonnes which is higher by 2.76 million tonnes than the Five Year average production of 20.26 million tonnes. Pulses account for 20 per cent of the area under foodgrain and cntributed around 7-10 per cent of the total foodgrains production in country. Madhya Pradesh, Maharasthra, Rajasthan, Uttar Pradesh and Karnataka are the top five pulses producing stastes and productivity of pulses is 764 kg/ha. Pulses are rich source of protein and can play vital role in fulfilling the rquirement of swiftly increasing population. India is the world's first largest producer (25%) and consumer (27%) of pulses and importer (14%) of pulses in the world. Globally, different pulses are cultivated in 83.3 million hactares in 171 countries with the production of 81.8 million tonnes. India is world's largest producer, accounting for 34% of area and 24% of production. The total consumption of various pulses and pulse products in India about 21 - 22 million tonnes. The most imported pulses are pegionpea, chickpea, blackgram, lentil and greengram, along with it being the largest importer of pulses, it is also largest producer of the same. Almost 24 per cent of total GDP in terms of Global output is been contributed by pulses in the country. India imported pulses worth over 110 billion Indian rupees in financial year 2021, an increse from the previous financial year.

Almost pulses are mainly being grown on marginal and sub-marginal land under rainfed conditions with low input usage and less than 15% of area under pulses is irrigated, exposing its production to weather-related yield risks.

Blackgram (Urd), the third important crop grop, was cultivated over an area of 5.44 million ha (Kharif + Rabi) and recod a production of 3.56 Mt at a

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productivity level of 655 kg/ha. this was the highest ever area, production and productivity in this crop. Major contributing state have been MP, Rajasthan, AP, UP, Tamilnadu, Mahrastra Jharkhand and Gujrat.

It was for the first time since plan intervention on pulses that nation inscribed a success by achieving higher production at 23.13 Mt and 25.23 Mt during 2016-17 and 2017-18.

Major increment was recorded in kharif production i.e. 62 per cent mainly due to lion share contributed by urd (82 per cent) followed by tur (52 per cent) and mung (34 per cent).

The mandate, of the Krishi Vigyan Kendra (KVKs) are application of technology through assessment, refinement and demonstration of proven technologies under different 'micro farming' situations in a district (Das, 2007). The production and productivity of Blackgram (Urd) is not adequate in the district due to use of poor quality seed, poor production technology, attack of yellow mosaic virus (YMV), and incidence of insect- pests. Therefore, it is necessary to demonstrate production and protection technologies to the farmers which are not adopted by them. Taking into the concentration cluster front line demonstrations were conducted on Kharif black gram (Urd) (var. PU 31). The major objectives of the study was to demonstrate the performance of recommended high yielding black gram variety with full recommended package of practices and to compare the yield levels of Farmers' practice.

Methodology

The present study was coduct with aim to assess the impact of cluster front line demonstration on production of blackgram. The cluster front line demonstration of kharif on blackgram for the year 2016 and 2017. Guide line of Cluster Frontline Demonstration to KVK by ICAR-ATARI, Kanpur Zone III. According CFLDs under blackgram (Urdbeen) laid out in ten villages. The knowledge level of the farmers in these villages was also evaluated by random sample of 30 farmers each village. Thereby sample included 300 numbers of farmers in the study. The farmers were asked to reply questions about the improved agro techniques including the high yielding varieties of blackgram. The score so obtained under various questions were summed-up. On the basis of the total score obtained, respondents were categoriezed on to three classes i.e. low, medium and high level of knowledge.

The soil sample were taken and analysis before sowing of CFLDs demonstrations.The soil of CFLDs fields were found sandy loam to clay loams having 0.3 to 0.6 per cent available organic carbon, 240 to 290 kg/ha nitrogen, 29 to 47 kg/ha available P_2O_5 and 60 to 120 kg/ha available potassium with pH range from 6.5 to 7.9. CFLDs on Blackgram were cultivated during kharif season and sown first fortnight of August. Black gram crop was sown in line and fertilize with a common dose of N:P:K:S @ 20:60:40:25 kg/ha. Full Nitrogen, Phosphorus, Potash and Sulpher applied at the time of sowing. Nitrogen was use as starter dose of crop. Seed Treatment done by using carbandazim @ 2g/kg seed 2 to 3 days beforeof sowing. Soil treatment of CFLDs demonstration fields were taken by using trichoderma @ 5 kg/ha and plant protaction measures adopted during crop period.

Participating farmers were provide with all advance technical know how about advanced cultivation of blackgram crop.Scientist of KVK also visited regularly to the demonstrations fields and continously guided the farmers. The variety PU 31 was utilized for collaction of feedback information for more improvements in technology transfer programme. field days and group meeting were also organised at demonstration site to provide the opportunities for other farmers to witness benefits of demonstration technologies. The dataon Blackgram productivity (q/ha) were collacted from the demonstration and control plot (Farmers Practice) for further analysis. The critical inputs were duly supplied to the farmers by KVK. Data were collacted fro the field of CFLDs farmers and analysed to compare the yield of farmers' field and CFLDs fields. The technology gap, extension gap and technlogy index I and technology index II were were estimated by using formulae provided by Samue *et.al.* 2000.

Technology gap = Potential Yield – Demonstration Yield

Extension gap = Demonstration Yield – Farmers Practice Yield (control)

Technology index I

$$= \frac{\text{Potential Yield-Demonstration Yield}}{\text{Potantial Yield}} \times 100$$

Technology index II

$$= \frac{\text{Demonstration Yield – Check Yield}}{\text{Demonstration Yield}} \times 100$$

Results and Discussion

Knowledge Level of Advanced Agronomic Practices of Blackgram (Urd)

To know the need of the technological intervantion the knowledge level of the farmers in ten villages were estimete from 300 farmers from 30 farmers each village. Over all maxium number of farmers fall in category of poor level kowledge, while very fiew with high knowledge level (Tabl 1). thus the need was felt to introduce latest varieties and nutrient management in CFLDs programme in 06 villages. CFLDs are good extension tool to demonstrtion the impact of new agro techniques to the farmers.

Table 1: Overall knowledge level of farmers in respect of cultivation of Black gram (Urd) N= 300

Category of Knowledge level	Score Range	No. of Farmers	% of respondent
Low	30-35	146	49
Medium	36-54	108	36
High	55-75	46	15

Yield and Technological index I & II :

Implementation of improved production technology remarkably increased the yield (94.44) over farmers practice during both years of CFLD demonstration. The average yield recommended practice (CFLD) was obtained 13.66 q/ha as compared to farmers' practice 7.03 q/ha, which was 94.44 per cent higher (Table 2). Yield obtained under CFLD demonstration at par than potential yield of variety. It may be due to cumulative effect of several biotic and a biotic factors in micro climatic condition and good management of agronomic practices.

Yield enhancement under recommended practice might be due to balance nutrition as per soil test value, integrated approach, involving fertilizers and bio fertilizers which play a vital role in making availability of plant nutrients. Similar results were Singh et.al. (2019), Tomar et.al. (2003).

Technology gap is the gap in the demonstration yield over potential yield was found 0.34 q/ha while extension gap was recorded 6.64 q/ha. The technology gap was found very less that's mean the application of technological intervention and climatic condition are good for the variety. But to minimize the extension it is need to educate the farmers through various means for more adoption of improved high yielding variety and recommended practices to bridge the wide extension gap. This extension gap requires urgent attention from planners, scientists, extension personnel, development department and NGOs working in the agricultural fields.

Technology index shows the feasibility of the evolved technology at the farmer's field. The lower the value of technology more is the feasibility of the technology. The Data showed in table 3 that adopting advance production technology under CFLD demonstration produce at par than the potential yield of variety and it reflected technology index I (1.43 - 3.43). The two years average yield of CFLD demonstration technology I was found 2.43 per cent. Technology Index II of CFLD blackgram was found higher (48.57) over farmers' practice.

Data presented in table 3 revealed that demonstration technology had impact over farmers' practice. It might be due to cumulative effect on average yield of district, technology index I and technology index II due to good management of CFLD and technology spread among the farmers of district. The average yield increased in CFLD demonstration field due to technology intervention may happen in other similar situation the results agreement with Singh, *et.al.* (2019), Roy *et.al.* (2006) and Tomar *et.al.* (2003)

Economical Assessment

Input & output prices of commodities prevailed during each year of demonstration were taken for calculating cost of cultivation, net return and benefit

Table 2: Performance of technological intervention (CFLD) on Yield (q/ha)

Year	Yield Potential (q/ha)	Yield obtained (q/ha)						Yield increase (%)	Technology gap	Extension gap
		Check			Demo					
		Maximum	Minimum	Average	Maximum	Minimum	Average			
2016	14.00	8.50	6.50	6.95	15.10	12.20	13.52	94.52	0.48	6.57
2017	14.00	8.90	7.20	7.10	15.30	12.30	13.80	94.36	0.20	6.70
Average	14.00	8.70	6.85	7.03	15.20	12.25	13.66	94.44	0.34	6.64

Table 3: Performance of technological intervention (CFLD) on technology index I & II

Year	Area (ha)	Demo (No)	Variety		National av. yield (q/ha)	State av. yield (q/ha)	District av. yield (q/ha)	Potential yield of demo variety	Technology Index I	Technology Index II
			Check	Demo						
2016	10	25	Shekhar	PU 31	6.55	3.20	10.70	14.00	3.43	48.59
2017	10	25	Shekhar	PU 31	6.55	3.20	10.70	14.00	1.43	48.55
Average	10	25	-	-	6.55	3.20	10.70	14.00	2.43	48.57

Table 4: Economical comparison between CFLD demo and farmers' practice

Year	Sale Price (Rs/q)	Expenditure and return (Rs/ha)								Net income increase (%)
		Check				Demo				
		Gross Cost (Rs/ha)	Gross Income (Rs/ha)	Net Return (Rs/ha)	B:C ratio	Gross Cost (Rs/ha)	Gross Income (Rs/ha)	Net Return (Rs/ha)	B:C ratio	
2016	5000	21700	34750	13050	1.61	26200	67600	41400	2.58	217.0
2017	5400	22300	38340	16040	1.71	27400	74520	47120	2.71	194.0
Average	5200	22000	36545	14545	1.66	26800	71060	44260	2.65	205.5

cost ratio (table 4). The investment on production by adopting improved technologies (cost of cultivation) were 26200 to 27400 Rs/ha with a mean value of 26800 Rs/ha against farmers' practice where the variation in cost of production were 21700 to 22300 Rs/ha with an average of 22000 Rs/ha. Cultivation of blackgram under improved technologies gave higher net return 41400 & 47120 Rs/ha compared to 13050 & 16040 Rs/ha under farmers' practice in the corresponding years. The average benefit cost ratio of CFLD demo was 2.65, and that of farmers' practice 1.66. The average net return increase 205.5 per cent higher than that of farmers' practice. This may be due to higher yields obtained under CFLD technology compares to farmers' practice. The result suggested economics viability and agronomic feasibility of technology for blackgram cultivation as reported Singh *et.al.* (2019), Deshmukh *et.al.* (2005) and Pathak (2005)

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AGRI MEET
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Management of Nitrogen in Paddy Crop through Innovative Leaf Colour Chart

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Introduction

Paddy is one of the most staple and nutritive food crop for human all over the world. It requires nutrient elements for their establishment and survival. Among those nutrient elements, optimal N supply matching with the actual crop demand is thus vital for improving crop growth and maximizing production. Nitrogen (N) is necessary for all forms of life and is a crucial component for increasing production of food to feed the continuously increasing human population (Abrol *et al*., 2012). Nitrogen is the most–scarce and highly mobile element in nearly all soils. Thus, adequate N fertilizer application is essential for normal crop growth and grain yields (Zapata, 2008). Inadequate and/or ineffective fertilizer N management can be harmful to crops and the environment. The goal of optimal N management systems is to match fertilizer N supply with real crop needs, optimizing crop N absorption while minimizing N losses ensuring low risk of environmental pollution. Judicious use of N fertilizer makes crop less prone to lodging and certain insect pests and diseases. Two major strategies followed in N management are 1) Blanket fertilizer N recommendations 2) Crop-need-based N management. Blanket-fertilizer N recommendations do not consider variability in soil N supply and changes in crop demand. Crop-need-based N management approach takes into account variability in soil N supply and crops' additional requirement for N fertilizer. Several

techniques are used to measure greenness including near-infrared leaf N analysis, chlorophyll meters, leaf color charts, crop canopy reflectance sensors and remote sensing (Giller *et al*., 2004). Based on leaf area, the chlorophyll meter, also known as SPAD (soil plant analysis development), may swiftly and consistently measure a crop's N condition. It has been used effectively in rice (Follett et al., 1992**)**. Many Asian farmers are unable to get chlorophyll meters because to their expensive cost. The leaf colour chart (LCC) developed by IRRI, Manila, Philippines is a low-cost alternative to the chlorophyll meter (Balasubramanian *et al*., 1998). LCC are a simple, fast, inexpensive and non-destructive technique for determining and managing the nitrogen content of rice leaves by farmers without any help from others (Scharf *et al*., 2011). It is an ideal tool & ecologically-friendly to optimize Nitrogen use efficiency irrespective to N applied.

Role of LCC in Nitrogen management in paddy

Proper nitrogen management in rice influences yields and grain quality. Monitoring of plant N status is important in improving the balance between crop N demand and N supply from soil and applied fertilizer. The LCC is used to monitor leaf N status from tillering to panicle initiation or later, by either of two equally effective options. The leaf colour chart consists of 4 or 6 green strips, 1st strip with light green colour and the last strip (4th or 6th) with dark green colour and in between strips (2nd to 5th) is with varying intensity of green colour.LCC is the chart which appears that of paddy leaves and having the colour from dark green to yellowish green colours. Yellowing of leaves in paddy indicates the deficiency of nitrogen, but it is difficult to decide the quantity of nitrogen to be applied based on the extent of yellowing. The concentration green or yellowish green colours of LCC reflect the N concentration (deficient or sufficient) of paddy leaves. Dark green colour of a leaf represents the abundant nitrogen status of that leaf and increases in yellow colour shows the severeness in deficiency of that leaf.

Assessment of N requirement through LCC critical value by using of Leaf Colour Chart

1. Randomly select ten disease free paddy plants from the field for assessing the leaf colour.

2. Match the colour of the selected leaves by keeping the middle of the leaves on the colour strips of leaf colour chart and assess the colour intensity (LCC value) during morning hours (8-10 am).
3. Measure the leaf color against the shade of your body, because direct sunlight affects leaf color readings. If possible, it should be ensured that the readings are taken by the same person.
4. If the color of a paddy leaf is in between two colour strips of the chart, then take average of two values as the reading.
5. Assessment of the leaf colour with LCC should be start at 14 days after transplanting of paddy or 21 DAS (days after sowing) in direct seeded rice.
6. LCC readings should be repeat in every 7 days for 110-130-dayrice crops and every 10 days for more than 130-daycrops until panicle emergence.
7. Critical LCC values vary considerably among different rice genotypes having different genetic background, plant type and leaf colour. LCC critical value is 3.0 in low N response cultures and 4.0 in other cultivars and hybrids.
8. Assess the average LCC values of 10 leaf samples. When the average LCC value of ten leaves or when the LCC values of five or more leaves found below the LCC critical value, then top dress nitrogen depending on the crop growth and stage.

Generally, application of N is recommended on the basis of LCC critical values as follow as:

S. N.	Season	LCC critical value	N requirement (kg)
1.	Wet season (Kharif)	3	23
2.	Direct seeded*	3	23
3.	Boro rice*	4	35

* 23 kg of N should be applied as basal dose

Nitrogen supplied through various organic manures

Organic manure has been used to improve soil fertility and enhance crop productivity by providing all the nutrients that are required by plants but in limited quantities. It helps in maintaining C:N ratio in the soil. These organic manure supplied N to the soil in low quantity

after mineralization process, which is available for crop. Application of organic manure increases organic elements' availability in soil, thereby improving the nutrient use efficiency (NUE) of crops and alleviating the harmful impact of climate change on crop production. Various kinds of organic manure are available for supply of N are as follows:

Organic material[a]	Water	C	N
	(%)	(% of fresh material)	
Human feces			1.0
Cattle feces			0.3
Pig feces			0.5
Fresh cattle manure	60	8–10	0.4–0.6
Composted cattle manure	35	30–35	1.5
Pig manure	80	5–10	0.7–1.0
Poultry manure	55	15	1.4–1.6
Garbage compost	40	16	0.6
Sewage sludge	50	17	1.6
Sugarcane filter cake	75–80	8	0.3
Castor bean cake	10	45	4.5

[a]kg nutrient per t fresh manure = % nutrient content × 10

(*Source: Fairhurst et al., 2007*)

Advantages of Leaf Color Chart

- It is a simple and easy to use tool for farmers to assess the time of N required by the crop at different stage.
- It is very effective in avoiding over application of N fertilizers, which reduce the rate of soil degeneration, water, and ecosystem.
- It offers harmonious behavior of N to the crops, which can be enhanced N use efficiency.
- It helps to reduce cost of cultivation by the judicious application of N.

Conclusion:

It seems that improper application of nitrogen is subjected to many losses from the rice field and also creating environmental pollution. Therefore, it should be applied at required quantity

and at required time to enhance the yield and nitrogen use efficiency. It can be easily achieved by leaf colour chart. LCC-based N management assures optimal rice yields consistent with efficient N use and enhanced farmers' profits due to the saving in the use of N fertilizers. LCC is a simple, cheap, and easy-to-use tool that can help farmers manage N judiciously.

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RESEARCH ARTICLE

Recent Advancements and treatments in Recurrent Spontaneous Abortion : An Overview

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Abstract

Two or more successive pregnancy losses before the 20th week of pregnancy are referred to as recurrent spontaneous abortion (RSA). Recurrent spontaneous abortion has an etiology that is mostly unknown, multifactorial, with a lot of discussion about diagnosis and care. In this review we talked about the causes and the method to treat recurrent spontaneous abortion (RSA). Anatomical, gastrointestinal, and placental disorder, hormone concerns, illness, cigarettes and alcohol consumption environmental conditions, mental illnesses and traumatic life experiences, as well as some coagulation and protein deficiency responsible for immune system control, are all logical etiologic triggers.

In addition, the immune response plays an important role in human reproduction. Infertility, polycystic ovary syndrome, IVF success, obstetrical success, and male gonadal function have all been linked to vitamin-D. Low vitamin-D levels can boost the risk of obstetric problems during pregnancy. The majority of (RSA) cases, however, are undescribed, which can be attributed to autoimmune and isoimmune antibodies, which could play a role in pregnancy immunologic failure and abortion. The ability to recognize pregnancy immunologically is critical for the continuation of pregnancy. Anti-HLA antibodies may be prevented by inadequate identification of antigens from an unborn child or increased HLA exchange with the parent. Abortion is linked to lower levels of antiidiotypic antibodies (Ab2), anti-paternal cytotoxic antibodies (APCA), and mixed lymphocyte reaction blocking antibodies (MLR-Bf) in women with (RSA), according to several reports.

Thrombolytic therapies such as aspirin as well as heparin, intravenous immunoglobulin (IVIg) treatment, lymphocyte vaccination with parental lymphocytes, and newly used (RSA) drugs are all efficient.

Keywords: Recurrent Spontaneous Abortion, Immunologic Factors, Natural Killer Cell, Aspirin, Heparin.

Introduction

In terms of its social and economic consequences, spontaneous miscarriage is a significant problem. Females are delaying conception until they are in their thirties or forties more often these days, and fertility is declining as a result, the rate of spontaneous abortion rises after the age of 30–35 years. Abortion is characterized as the termination of a pregnancy before 20 weeks of pregnancy or when the baby weighs less than 500 gm; it can be spontaneous, threatened, imminent, complete, or incomplete (Lin *et al.*, 2018). The most common pregnancy complication is abortion (Moradinazar *et al.* 2020).

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In around half of RSA cases, no etiologic element has been reported (Yang *et al.* 2017). Unsafe abortion is still a significant public health issue around the world, with the World Health Organization reporting 21.6 million unsafe abortions in 2008 (Lin *et al.* 2018). For all pregnant women, a spontaneous miscarriage is a devastating loss. It affects around 1% of all females (Li *et al.* 2017).

Recurrent spontaneous abortion (RSA) was historically described as the 3 or more consecutive miscarriage just before 20th week of gestation (Pandey *et al.* 2005; Sarno *et al.* 2019). However, since clinical investigation and possible interventions might be too late if started after the third miscarriage, this term should be redefined to reflect the new social behavior of pregnancy at an older age. The American Society for Reproductive Medicine updated its concept of RSM in 2008, stating that it now includes two or more aborted pregnancies (Wang *et al.* 2017; Sarno *et al.*, 2019). Infertile couples have a higher risk of spontaneous miscarriage than the general population, according to an early analysis, and patients with a history of RSM have a higher incidence of infertility. However, another study found that the risk of spontaneous abortion is not higher in pregnancies conceived with assisted reproductive technology (ART) than in pregnancies conceived naturally. Recurrent spontaneous abortion has an underlying cause that is sometimes uncertain and can be highly variable, with considerable discussion about assessment and treatment. Recurrent miscarriage can be caused by a number of factors like, chromosomal, infection, smoking, low vitamin D levels (Li *et al* 2019; Sereshki *et al* 2014; Tian *et al.*, 2020; Samimi *et al.*, 2017). and alcohol intake, as well as genetic, anatomical, endocrinological, stress factors and placental abnormalities (Adib-Rad *et al.*, 2019). In addition, certain autoimmune and isoimmune factors can play a role in RSA-positive women's pregnancy immunologic collapse (Wu *et al.*, 2017).

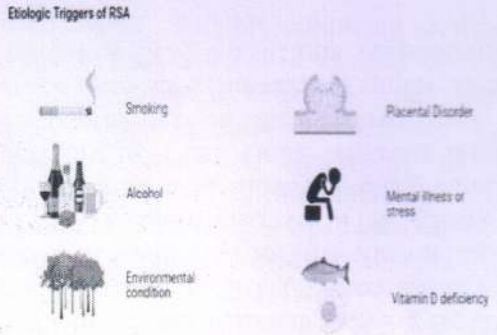

Fig. 1 Etiologic Triggers of RSA

Changes in HLA-G molecule expression, T-helper-1 cytokine sequence, and natural killer (NK) cell cytotoxicity may also induce abortion in women with RSA. The immunological interaction between the mother and the embryo is a 2 way interaction defined on the one side by perinatal antigen exposure and on the other side by the mother's immune system's recognition and reaction to these antigens. Antithrombotic therapies like heparin and aspirin, intravenous immunoglobulin (IVIg) medication, parental lymphocyte vaccination, and the newly utilised 1alpha, 25-dihydroxyvitamin-D3 (VD3) treatments are all important medications for the isoimmune cause of RSA (Coulam 1991; Lv *et al.* 2018). Their findings are the result of proper humoral factor induction, which results in a transition from Th-1 to Th-2 level, which leads to substantial immune system changes. The function of NK cells is hindered in females with RSA.

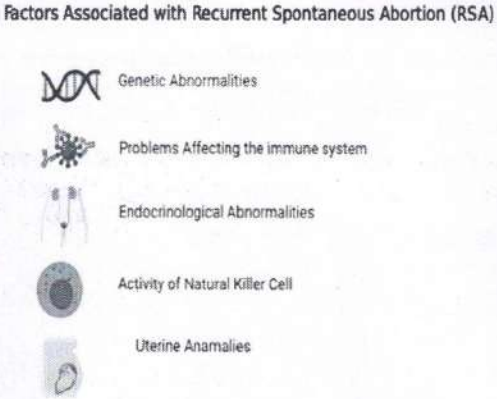

Fig. 2 Factors associated with recurrent spontaneous abortion (RSA)

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Research Paper

Genetic diversity analysis in bread wheat (*Triticum aestivum* Linn. Emend Thell.) for yield and its contributing characters

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ABSTRACT

The present investigation was carried out with 21 diverse genotypes of bread wheat incompletely randomized block design with 3 replications at Krishi Vigyan Kendra, Bilari, Moradabad to assess these released varieties, their 12 quantitative characters viz. days to maturity, plant height (cm), no. of effective tillers/plant, flag leaf length (cm), flag leaf width (cm), flag leaf area (cm^2), spike length (cm), no. of grains/ spike, biological yield (g), 1000-grain weight (g), harvest index (%) and grain yield/ plant (g) for genetic diversity for yield and its contributing traits under normal sown condition. The statistical analysis for genetic divergence was done using Mahalanobis-D^2statistics and clustering of genotypes using Euclidean method. On the basis of genetic diversity analysis, it was found that the maximum percent contribution towards genetic divergence was from number of effective tillers per plant and minimum by grain yield per plant. Clustering of genotypes revealed that cluster-III has maximum number of genotypes (07), clusters I and VI each have 04 genotypes, clusters II have 3 genotypes, clusters VI have 2 genotypes while clusters V has only one genotype. The high estintra-cluster distance was shown by cluster-VI (81.607) revealing maximum genetic divergence among its constituents. The highest inter-cluster distance was found between clusters V and VI (548.020) and the lowest was between cluster-II and III (96.157). Cluster-I exhibited highest cluster means for the traits 1000-grain weight and harvest index, Cluster-VI for grain yield per plant, number of grains per spike and biological yield while clusters-II and IV revealed highest cluster means for leaf width and leaf area. The genotypes having desired values from different clusters can be exploited in further breeding programme for the development of high yielding wheat genotypes.

Key words: D^2 statistics, Genetic diversity, intra-inter clusters

Wheat (*Triticum aestivum* L.) is the most widely grown crop and an essential component of the global food security, providing one-fifth of the total calories for the world's population. In India, the 91 per cent wheat area is spread over in eight states *viz.* Punjab, Haryana, Delhi, Uttar Pradesh, Rajasthan, Gujarat, Bihar and Madhya Pradesh. Uttar Pradesh is the leading wheat producing state, which shares more than 36 per cent both in area and production in the country. Uttar Pradesh occupies an area of 9.35 million hectares and has recorded production of 32.089 million tones with productivity of 34.32 q/ha. The highest productivity state is Punjab producing 51.90 q/ha (Anonymous, 2020).The Genetic diversity and relationship among genotypes is a prerequisite for any successful breeding programme (Wani *et al*. 2020). Genetic diversity of plants determines their potential for improved efficiency and hence their use for breeding, which eventually may result in enhanced food production. Evaluation of genetic diversity levels among adapted, elite germplasm can provide predictive estimates of genetic variation among segregating progeny for pure-line cultivar development. Genetic similarity or dissimilarity can be compared by genetic distance among different individuals. Genetic distance can be used to measure the genetic divergence between different sub-species or different varieties of a species. The parents having more genetic distant relationship result into higher heterotic expression in F_1 and greater amount of genetic variability in segregating populations (Shekhawat *et al*., 2001, Khokhar *et al.* 2019).

Genetic diversity of genotypes is not always based on factors such as geographical diversity, place of release and ploidy level etc. Hence characterization of genotypes should be based on statistical procedures. Different statistical methods have been developed to assess the genetic diversity such as D^2-statistics and hierarchical Euclidean cluster analysis. These methods determine the genetic divergence using the similarity or dissimilarity based on aggregate effect of different economic important traits. Some appropriate methods,

cluster analysis, genetic diversity identification, parental selection, tracing the pathway to evaluate crops, centre of origin and diversity (Mohammadi and Prasanna, 2003; Wani *et al*. 2018; Wani *et al*. 2020). Genetic improvement of yield especially in self-pollinated crops depends on nature and amount of genetic diversity (Joshi and Dhawan, 1966). The most common approach for wheat breeding is hybridization and subsequent selection. Parents' choice is the first step in plant breeding program through hybridization. Higher heterosis in progeny can be observed with higher genetic distance between parents (Joshi and Dhawan, 1966). Estimation of genetic diversity is one of appropriate tools for parental selection in wheat hybridization programmes. This study is to estimate the genetic diversity among the genotypes for further utilization in hybridization programme.

MATERIALS AND METHODS

The research related to genotypic/phenotypic screening, was carried out in the crop cafeteria of Krishi Vigyan Kendra, Bilari, Moradabad during the *Rabi* 2019-20. The experimental material consists of 21 released varieties of bread wheat namely: K-7903, K-1006, K-402, K-9644, K-65, K-607, K-307, K-424, K-9465, K-9006, K-9351, K-9162, K-1317, K1601, K-1313, K-8962, K-9423, K-9533, K-8434, K-9107 and K-68 were evaluated in three rows of 3 meter long. Row to row and plant to plant distance was kept 23 cm and 5 cm, respectively, in Randomized Block Design (RBD) with three replications. All the recommended package of practices for wheat was followed to raise a healthy crop. The data were recorded for 12 characters namely: days to maturity, plant height (cm), no. of effective tillers/plant, flag leaf length (cm), flag leaf width (cm), flag leaf area (cm^2), spike length (cm), no. of grains/ spike, biological yield (g), 1000-grain weight (g), harvest index (%) and grain yield/ plant (g)and were subjected to various statistical analyses as usual procedure. Flag leaf area were recorded as per method given by Lazerov, 1965 [(leaf length x leaf width at maximum) x 0.66]. The statistical analysis for genetic divergence was done using Mahalanobis-D^2 statistics (Mahalanobis, 1936) and clustering of genotypes was done using hierarchical Euclidean cluster analysis.

RESULTS AND DISCUSSION

The present investigation showed that all the 21 genotypes were grouped into six clusters (Fig. 1 and Table 1) suggesting considerable amount of genetic diversity in the material. The cluster-III had highest number of genotypes (07) followed by cluster-I & IV (04 genotypes in each), cluster-II (03), cluster-VI (02) clusters-V had single genotype only. The cluster-I consisted of genotypes *viz.*: K 7903, K 9162, K 0307, K 1317. The genotypes K 0607, K 9465 and K 9107 were grouped into cluster-II. Cluster –III having seven genotypes, namely, K 9644, K 65, K 9006, K 9351, K 1313, K 1601 and K 1006. Cluster-IV had K 8962, K 9533, K 9423 and K 68 varieties. The pattern of distribution of genotypes in different cluster exhibited that geographical diversity was not related to

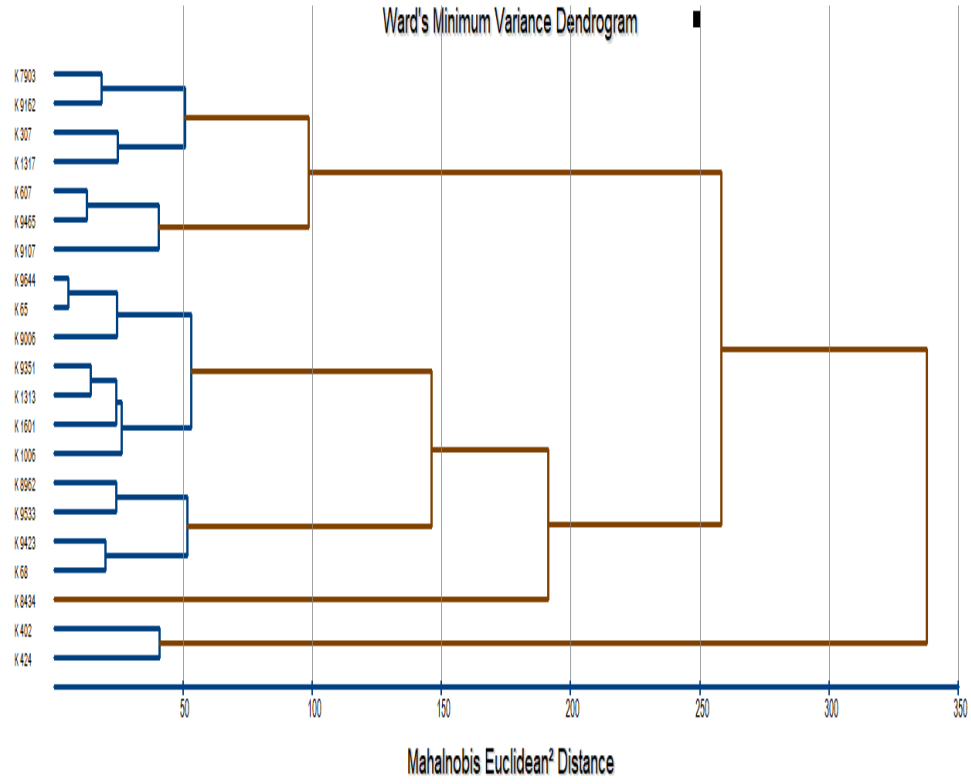

Fig. 1: Dendrogram for 21 genotypes showing relationship among them

genetic diversity, varieties of same geographical region were grouped into different clusters (Kumar *et. al.*, 2009; Rahman *et al*., 2015; Wani, *et al*., 2018; Wani, *et al*., 2020).

Table 1: Distribution pattern of 21 genotypes under different clusters

Clusters	Number of genotypes	Name of genotypes
Cluster-I	4	K 7903, K 9162, K 0307, K 1317
Cluster-II	3	K 0607, K 9465, K 9107
Cluster-III	7	K 9644, K 65, K 9006, K 9351, K 1313, K 1601, K 1006
Cluster-IV	4	K 8962, K 9533, K 9423, K 68
Cluster-V	1	K 8434
Cluster-VI	2	K 402, K 424

On the basis of genetic diversity analysis, the maximum percent contribution (Table 2) towards genetic divergence was from number of effective tillers per plant i.e. 27.14% followed by plant height (22.38%), flag leaf length (20.00%), spike length (15.24%), flag leaf area (5.71%), 1000-grain weight (4.29%), days to maturity (2.38%), biological yield per plant (1.90%) and minimum by grain yield per plant (0.95%). The remaining characters did not show contribution towards genetic divergence. The results were in agreement with those of Dobariya *et al.*, 2006 and Arya *et. al.*, 2017. The contribution of various characters towards the expression of genetic divergence should be taken into account as a criterion for choosing parents for crossing programme to the improvement in such characters. The intra and inter-cluster distances (Table 3) were calculated to determine the genetic relationship among the individuals within a cluster and between members of different clusters. The highest intra-cluster distance was exhibited by cluster-VI (81.607) followed by cluster-IV (63.634), cluster-I (62.418), cluster-II (53.321), cluster-III (49.010), suggesting that genotypes in cluster-VI were relatively more diverse than the genotypes in other clusters.

Table 2: Percent contribution of different characters towards genetic divergence

S. No.	Characters	Contribution %	Times Ranked 1st
1	Days to maturity	2.38%	5
2	Plant height (cm)	22.38%	47
3	No. of effective tillers/plant	27.14%	57
4	Flag leaf length (cm)	20.00%	42
5	Flag leaf width (cm)	-	
6	Flag leaf area (cm^2)	5.71%	12
7	Spike length (cm)	15.24	32
8	No. of grains/ spike	-	
9	Biological Yield (g)	1.90%	4
10	1000-grain weight (g)	4.29%	9
11	Harvest index (%)	-	
12	Grain yield/ plant (g)	0.95%	2

Inter-cluster distance is the main criterion for selection of genotypes using D^2 analysis (Khare *et al*., 2015). The genotypes belonging to those clusters having maximum inter-cluster distance are genetically more divergent and hybridization between these genotypes of different clusters is likely to produce wide variability with desirable individuals. The highest inter-cluster distance was found between clusters-V and VI (548.020)

Table 3: Intra and inter-cluster distance

	Cluster-I	Cluster-II	Cluster-III	Cluster-IV	Cluster-V	Cluster-VI
Cluster-I	62.418	98.577	119.869	167.488	317.544	214.323
Cluster-II		53.321	96.157	161.172	215.519	311.665
Cluster-III			49.010	102.275	262.743	237.240
Cluster-IV				63.634	210.469	254.328
Cluster-V					0.000	548.020
Cluster-VI						81.607

suggested a genetically distant relationship between these two clusters and high degree of genetic diversity among the genotypes followed by clusters-I and V (317.544), clusters-II and VI (311.665), clusters-III and V (262.743), clusters-IV and VI (254.328), clusters-III and VI (237.240), clusters-II and V (215.519), clusters-I and VI (214.323), clusters-IV and V (210.469), clusters-I and IV (167.488), clusters-II and IV (161.172), clusters-I and III (119.869), clusters-III and IV (102.275), clusters-I and II (98.577) while the lowest inter-cluster distance was observed between clusters-II and III (96.157) suggested a closer relationship between these two clusters and low degree of genetic diversity among the genotypes. Presence of substantial genetic diversity among the parental material screened in the present study indicated that this material may serve a good source for selecting the diverse parents for hybridization programme.

Cluster means were calculated for all the characters which exhibited considerable differences among the clusters. The mean performance of the clusters (Table 4) was used to select genetically diverse and agronomically superior genotypes out of 21 genotypes studied. The highest cluster mean for days to maturity was exhibited by cluster-V (127.10) followed by cluster-II (124.87), cluster-IV (122.90), cluster-VI (122.20), cluster-III (121.27) and the lowest by cluster-I (118.73). The highest cluster mean for plant height (cm) was observed in cluster-V (132.73) followed by cluster-IV (112.57), cluster-II (98.73), cluster-III (95.09), cluster-I (94.66) and the lowest of cluster-VI (91.07).The highest cluster mean for number of effective tillers per plant was observed in cluster-IV (8.68) followed by cluster-III (8.21), cluster-VI (7.57), cluster-V (6.80), cluster-II (6.08) and the lowest by cluster-I (5.81).

Table 4: Cluster means for different characters

Characters → **Clusters** ↓	Days to maturity	Plant height (cm)	No. of effective tillers/ plant	Flag leaf length (cm)	Flag leaf width (cm)	Flag leaf area (cm^2)	Spike length (cm)	No. of grains/ spike	Biological Yield (g)	1000-grain weight (g)	Harvest index (%)	Grain yield/ plant (g)
Cluster-I	118.73	94.66	5.81	25.80	1.97	33.55	15.79	35.87	77.28	37.90	35.87	27.67
Cluster-II	124.87	98.73	6.08	30.26	2.08	41.50	18.31	42.79	78.10	35.52	34.44	26.86
Cluster-III	121.27	95.09	8.21	29.29	1.97	38.09	18.26	38.22	79.06	35.09	33.97	26.72
Cluster-IV	122.90	112.57	8.68	28.99	2.09	39.99	15.98	33.63	70.16	36.15	34.96	24.53
Cluster-V	127.10	132.73	6.80	31.53	1.77	36.74	20.37	35.23	59.37	33.70	34.24	20.23
Cluster-VI	122.20	91.07	7.57	20.55	1.65	22.43	16.55	45.47	83.03	35.32	35.14	29.18

The highest cluster mean for flag leaf length (cm)was observed in cluster-V (31.53) followed by cluster-II (30.26), cluster-III (29.29), cluster-IV (28.99), cluster-I (25.80) and the lowest by cluster-VI (20.55).The maximum cluster mean for flag leaf width (cm) was exhibited by cluster-IV (2.09) followed by cluster-II (2.08), cluster-I& III (1.97), cluster-V (1.77), and lowest was exhibited by cluster-VI (1.65). The data showed maximum cluster mean for flag leaf area (cm^2) was observed in cluster-II (41.50) followed by cluster-IV (39.99), cluster-III (38.09), cluster-V (36.74), cluster-I (33.55) and minimum was exhibited by cluster-VI (22.43).

The highest cluster mean for spike length (cm) was observed in cluster-VI (20.37) followed by cluster-II (18.31), cluster-III (18.26), cluster-VI (16.55), cluster-IV (15.98) and the lowest was observed in cluster-I (15.79). The maximum cluster mean for number of grains per spike was exhibited in cluster-VI (45.47) followed by cluster-II (42.79), cluster-III (38.22), cluster-I (35.87), cluster-V (35.23) and minimum was in cluster-IV (33.63).The highest cluster mean for Biological yield (g) was observed in cluster-VI (83.03) followed by cluster-III (79.06), cluster-II (78.10), cluster-I (77.28), cluster-IV (70.16) and the lowest by cluster-V (59.37).

The highest cluster mean for 1000-grain weight (g)was exhibited by cluster-I (37.90) followed by cluster-IV (36.15), cluster-II (35.52), cluster-VI (35.32), cluster-III (35.09) and the lowest by cluster-V (33.70).The maximum cluster mean for harvest index (%) was observed in cluster-I (35.87) followed by cluster-VI (35.14), cluster-IV (34.96), cluster-II (34.44), cluster-V (34.24) and the lowest by clusters-III (33.97).The highest cluster mean for grain yield per plant (g) for cluster-VI(29.18) followed by cluster-I (27.67), cluster-II (26.86), cluster-III (26.72), cluster-IV (24.53) and the lowest exhibited by cluster-V (20.23). The present investigation is supported by Wani *et. al.* 2018 and Wani *et. al.* 2020.

In conclusion, the most important trait grain yield per plant caused maximum genetic divergence and was responsible for differentiating the genotypes studied. The highest inter-cluster distance was found among clusters-V and VI (548.020) suggesting that crossing between the members of these two clusters will lead to development of wide range of genetic variability and breeder will have greater chances to get desired segregants while the lowest inter-cluster distance observed between cluster-II& III (96.157) indicated that the genotypes in

these two clusters were relatively close to each other, exhibiting poor range of genetic variability. Cluster-VI exhibited highest cluster means for the characters number of grains per spike, biological yield and grain yield per plant and cluster-I was marked by highest cluster means for harvest index. The genotypes from these two clusters would also be promising if selected for hybridization programme for yield contributing traits. Inter and intra-cluster distance provide index of genetic diversity between and within clusters. It would be desirable to choose the donor from different clusters. Larger the distance between the clusters better the chances of getting transgressive segregants. These findings suggest that the experimental material had sufficient genetic diversity for yield and yield contributing traits. Diversity in these characters may be exploited through hybridization for the development of superior individuals for grain yield.

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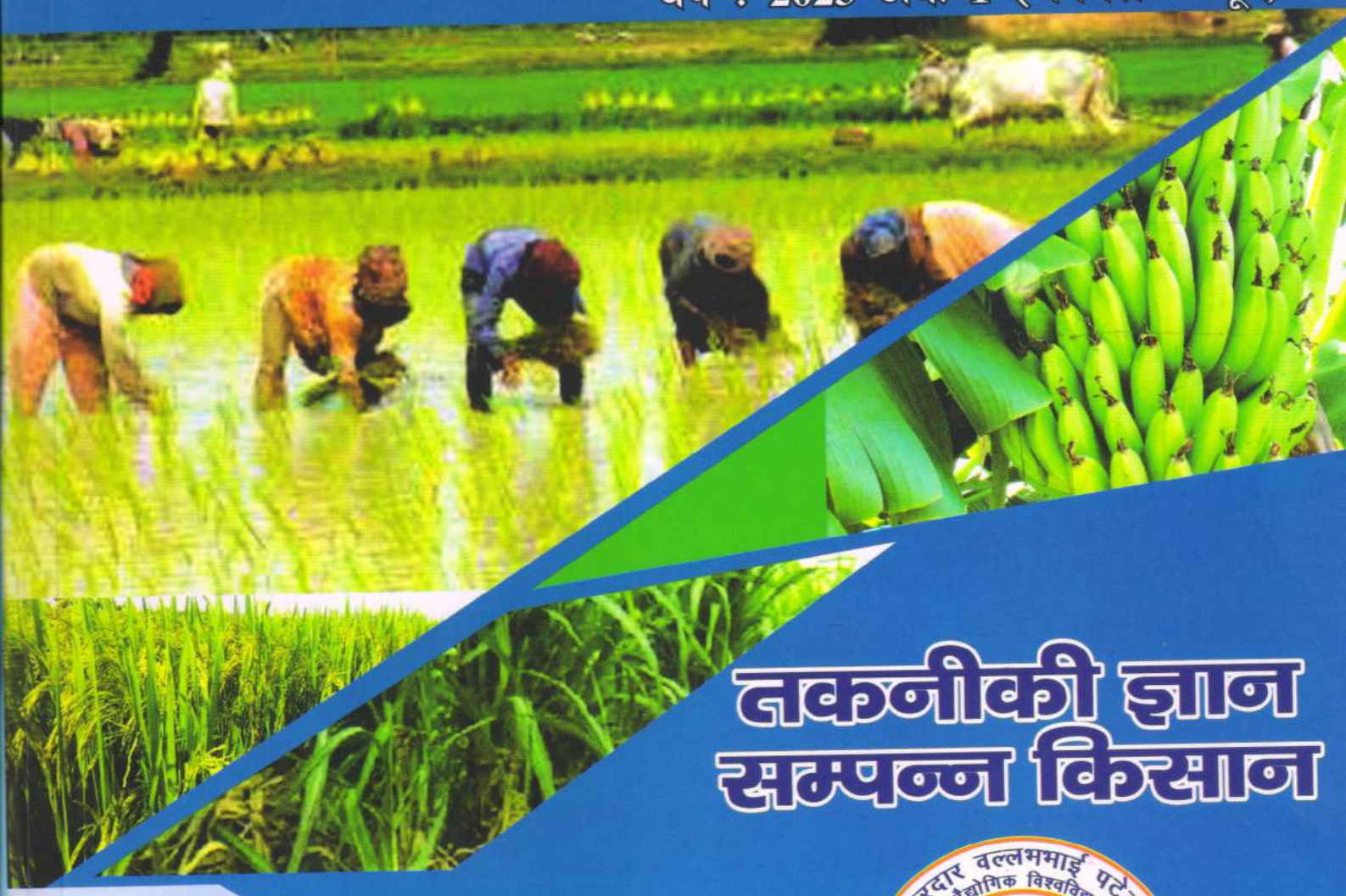
कृषि दर्शिका

आधुनिक कृषि एवं ग्रामीण विकास पत्रिका

वर्ष : 2023 अंक 1 (जनवरी - जून)



तकनीकी ज्ञान सम्पन्न किसान

सरदार वल्लभभाई पटेल कृषि एवं प्रौद्योगिक विश्वविद्यालय
मेरठ 250 110, उत्तर प्रदेश

कृषि दर्शिका

वर्ष 2023 अंक 1

जनवरी से जून 2023

व्यवसाय प्रबन्धक

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चंदे एवं विज्ञापन सम्बन्धी जानकारी के लिए प्रकाशक को पत्र लिखें।

पत्रिका की दरें

एक प्रति	35 रुपये
वार्षिक	60 रुपये
द्विवार्षिक	110 रुपये
दस वर्ष	550 रुपये
आजीवन (20 वर्ष)	1000 रुपये।

इस अंक में

प्रकाशक

सरदार वल्लभभाई पटेल कृषि एवं प्रौद्योगिक विश्वविद्यालय

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एकीकृत कृषि प्रणाली : एक कदम आत्मनिर्भरता की ओर

डॉ० सोनिका ग्रेवाल, डॉ० शिवम् सिंह, डॉ० संदीप चौधरी एवं इंजी० गौरव शर्मा

देश में लगातार बढ़ती जनसंख्या एवं प्राकृतिक संसाधनों में होने वाली कमी के कारण किसानों को भी अपने खेती करने के तरीके और तकनीक दोनों में बदलाव करने की आवश्यकता है। इस सन्दर्भ में एकीकृत कृषि प्रणाली काफी उपयोगी साबित हो रही है। वह किसान जिनके पास कम उपजाऊ भूमि है, उनको खेती से होने वाले आय से अपनी दैनिक आवश्यकताओं की पूर्ति करने में समस्याओं का सामना करना पड़ रहा है तथा साथ ही उर्वरक, खाद, रसायनों और विद्युत की दरों में वृद्धि ने कृषि पर होने वाले खर्च में वृद्धि की है। अतः विभिन्न कृषि घटकों को समेकित करके उत्पादन क्षमता में वृद्धि की जा सकती है।

एकीकृत कृषि प्रणाली कृषि का एक आधुनिक मॉडल है। इस कृषि तकनीक में किसान तरह–तरह की फसलें उगाने के साथ–साथ पशुपालन, कुक्कुट पालन, मत्स्य पालन, गृह सब्ज़ी वाटिका, मशरुम उत्पादन, केंचुआ खाद उत्पादन जैसे कार्य एक साथ कर सकते हैं। छोटे और सीमांत किसानों के पास खेती योग्य जमीन अधिक मात्रा में नहीं होती है, तब ऐसी स्थिति में अगर किसान आमदनी के लिए किसी एक फसल पर निर्भर रहेगा तो फसल खराब होने पर होने वाले नुकसान का डर बना रहता है। वहीं अगर छोटे किसान इस कृषि प्रणाली को अपनाते हैं, तो आमदनी के लिए एक फसल या उत्पादन इकाई पर निर्भर नहीं होता है और इस प्रकार किसान को साल भर आमदनी होती रहती है और उसकी आर्थिक स्थिति में भी सुधार होने में मदद मिलती है। इस कृषि प्रणाली में कृषि कम से कम दो या उससे अधिक घटकों को इस प्रकार से मिलाया जाता है कि एक के समायोजन से दूसरे के लागत में कमी हो, उत्पादन में वृद्धि हो और साथ ही साथ किसानों को वर्ष भर एक अच्छी खासी आमदनी प्राप्त होती रहे।

एकीकृत कृषि प्रणाली के मुख्य घटक :

1. फसल ;अनाज, दलहन, तिलहन, फल, सब्जियां, मसाले, रोपण फसलें, फूल, चारा/चारा फसल, गन्ना, रेशे वाली फसल इत्यादि।
2. पशुपालन व कुक्कुट पालन ;मवेशी, भैंस, सुअर, बकरी, भेड़, चिकन, बत्तख इत्यादि।
3. मत्स्य पालन ;मत्स्य पालन के लिए किसान के पास तालाब, अन्य जल के स्त्रोत होने चाहिए, जिसमें वह मत्स्य पालन कर सके।
4. द्वितीयक कृषि ;मधुमक्खी पालन, मशरूम उत्पादन, खाद्य प्रसंस्करण, केंचुआ खाद उत्पादन, बायो–गैस उत्पादन, अजोला की खेती, रेशम उत्पादन इत्यादि।

फसलें, पशुधन, मत्स्य पालन और द्वितीयक कृषि गतिविधियों को किसान की प्राथमिकताओं, कृषि जलवायु परिस्थितियों, प्रौद्योगिकी और बाजार आदि सुविधाओं को देखकर ही चुनी जाती है।

एकीकृत कृषि प्रणालियों के प्रकार :

विभिन्न उद्यमों पर आधारित एकीकृत कृषि प्रणालियों के प्रकार-

1. फसल–पशुधन प्रणाली
2. फसल–पशुधन–मछली पालन प्रणाली
3. फसल–पशुधन–मुर्गी–मछली पालन प्रणाली
4. फसल–मुर्गी–मछली–मशरूम पालन प्रणाली
5. फसल–मछली–कुक्कुट पालन प्रणाली
6. फसल–पशुधन–मछली–केंचुआ खाद कृषि प्रणाली
7. फसल–पशुधन–वानिकी कृषि प्रणाली

एग्रो इको-सिस्टम पर आधारित एकीकृत कृषि प्रणालियों के प्रकार :

पारिस्थितिक तंत्र के आधार पर, एकीकृत कृषि प्रणाली को चार वर्गों में वर्गीकृत किया जा सकता है:

1. सिचाईं आधारित क्षेत्र :

नियंत्रित सिंचाई प्रणाली में फसलों की एक विस्तृत श्रृंखला उगाई जा सकती है। सिंचाई आधारित क्षेत्रों में फसल के साथ दो या दो से अधिक घटकों को मिलाकर संसाधनों का बेहतर उपयोग, नियंत्रण एवम प्रबंधन करके एकीकृत कृषि की जा सकती है। उदाहरण– फसल + कुक्कुट + बायोगैस इकाई, फसल + डेयरी + बायोगैस इकाई तथा धान फसल + डेयरी + बायोगैस इकाई इत्यादि।

2. वर्षा आधारित और शुष्क भूमि वाले क्षेत्र :

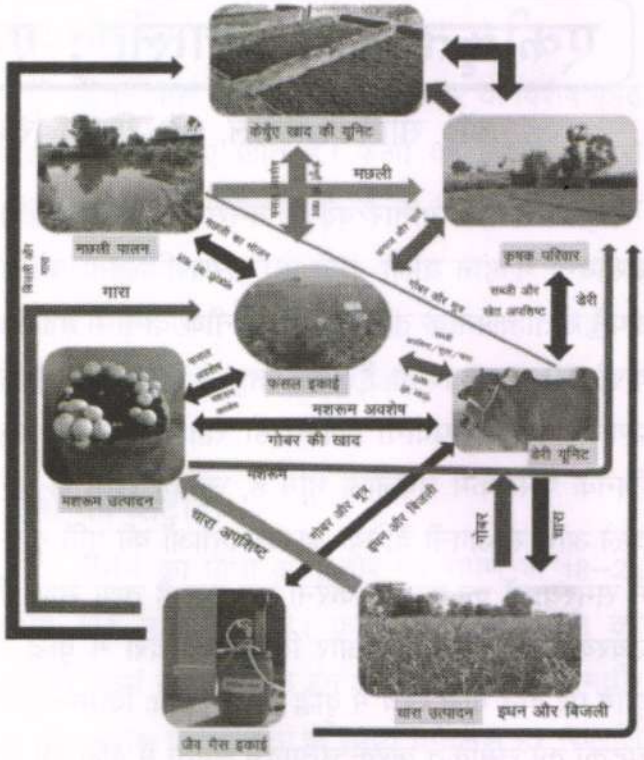
कम वर्षा वाले स्थानों पर वर्षा का अपर्याप्त और असमान होना, खराब और सीमांत मिट्टी, कम फसल सघनता, सीमित फसल विविधीकरण, कम मूल्य वाली फसल जैसी समस्याएं सामान्यतः देखने को मिलती हैं। उदाहरण– फसल + बकरी एवं फसल + बकरी + कृषि वानिकी + बागवानी इत्यादि।

3. पहाड़ी क्षेत्र:

यह प्रणाली पहाड़ी क्षेत्रों में उच्च ऊंचाई पर स्थित स्थानों पर प्रचलित है, जहां ढलान के कारण सिंचाई चैनलों का निर्माण संभव नहीं है। उदाहरण– कृषि + बागवानी + पशुधन कृषि + बागवानी + मत्स्य + पशुधन इत्यादि।

4. द्वीप :

उदाहरण– नारियल + सह + चारा + सह + दुधारू पशु



फोटो– एकीकृत कृषि प्रणाली के विभिन्न चरण

एकीकृत कृषि प्रणाली के लाभ –

- **उत्पादन क्षमता में वृद्धि :** इस कृषि प्रणाली में उत्पादन क्षमता में वृद्धि मुख्य लाभों में से एक है। इसमें प्रति इकाई क्षेत्र या उसमें लगी प्रति इकाई लागत इस कृषि प्रणाली में विभिन्न घटकों की उपज बढ़ाने के लिए लाभप्रद होती है।
- **लाभप्रदता :** इस कृषि प्रणाली में सभी घटकों के कच्चे माल एक इकाई से दूसरी इकाई के द्वारा उपयोग किये जाते हैं एवम इसमें आने वाले रख–रखाव की लागत को कम करने के साथ–साथ उप–उत्पादों जैसे कचरे, गोबर का पूर्ण प्रबंधन द्वारा उच्च लागत लाभ अनुपात मिलता है।
- **सम्पूर्ण आहार :** इस कृषि प्रणाली में सभी इकाइयों के विभिन्न घटकों द्वारा विभिन्न पोषक तत्वों का निर्माण होता है जिससे रोजमर्रा की खाद्य आपूर्ति सुचारु रूप से होती रहती है।

- **प्रदूषण मुक्त पर्यावरण :** इस कृषि प्रणाली मे सभी घटकों के अपशिष्ट पदार्थों (फसल अवशेष और पशुधन अपशिष्ट) को प्रभावी ढंग से पुनर्चक्रित किया जाता है जिससे प्रकृति की सुरक्षा बनाये रखने में मदद मिलती है।
- **साल भर आय का स्रोत :** इस कृषि प्रणाली में सभी इकाइयों के घटकों से साल भर कुछ न कुछ उत्पादन होता रहता है जैसे फसलें, दालें, अंडें, दूध, मछली, मशरूम, शहद, कोकून, रेशम कीट इत्यादि जिससे किसान को पूरे वर्ष आमदनी होती रहती है।
- **वर्ष भर हरा चारा :** ज़मीन के प्रभावी उपयोग के कारण, वार्षिक चारा वाली फसलों को लगाने से पशुओ के लिए साल भर हरे चारे की उपलब्धता हो जाती है जिससे पशुओ के दूध उत्पादन में वृद्धि भी होती है एवम चारा संकट से भी बचा जा सकता है।
- **बायो ईंधन और इमारती लकड़ी संकट को हल करना :** पशुओं के गोबर का प्रयोग बायो–गैस उत्पन्न करने के लिए किया जा सकता है जिसका उपयोग घर में खाना बनाने में ईंधन के रूप में किया जा सकता है। कृषि–सिल्वीकल्चर को जोड़ने से अन्य घटकों के खराब होने के बिना ईंधन या लकड़ी का लाभ उठाया जा सकता है।
- **रोजगार का स्रोत :** इस कृषि प्रणाली में कृषि के विभिन्न उद्यम जैसे पशुपालन, बत्तख पालन, मुर्गी पालन, मछली पालन से किसानों को रोजाना आय प्राप्त हो सकती है जिससे वह अपनी दैनिक आवश्यकताओं को पूरा कर सकते हैं एवम इससे बेरोजगारी की समस्या को कम किया जा सकता है।
- एकीकृत कृषि प्रणाली को अपनाते हुए किसान अपने उपलब्ध संसाधनों का भरपूर दोहन करते हुए फसल उत्पादन में वृद्धि के साथ साथ कृषि के विभिन्न उद्यम जैसे मवेशी पालन, बत्तख पालन, मुर्गी पालन से प्रतिदिन अपनी आय में वृद्धि कर सकते हैं। इस कृषि प्रणाली में साल भर प्रत्येक इकाई से कुछ न कुछ उत्पादन जैसे फसलें, दालें, अंडें, दूध, मछली, मशरूम, शहद, कोकून रेशम कीट इत्यादि होता रहता है जिससे किसान को पूरे वर्ष आमदनी होती रहती है। साथ ही इस प्रणाली को अपनाकर हम मृदा–उत्पादकता को बरकरार रखते हुए अपने पर्यावरण को भी सुरक्षित रख सकते हैं।

नारी शक्ति

पढ़ी लिखी होगी जब नारी, तब सुलझेगी उलझन सारी।
महिलाओं का हो उत्थान, अपना घर हो स्वर्ग समान।
महिलाओं का एक सपना, घर में हो उद्यम अपना।
नारी शक्ति जब बढ़ जायेगी, जुल्म की संख्या घट जायेगी।

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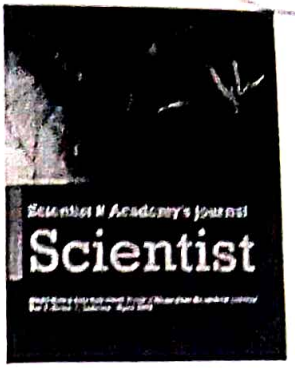

Research Article

EFFECT OF MOISTURE CONSERVATION PRACTICES AND SOIL APPLIED ZINC ON QUALITY PARAMETERS AND YIELD OF *KHARIF* MAIZE (*Zea mays* L.) IN WESTERN U.P.

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ABSTRACT

A field experiment was carried out during *kharif* season of 2020 and 2021 at Crop Research Centre (main Campus) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.), India. The soil of experimental field was sandy loam in texture, alkaline in reaction, low in available nitrogen and organic carbon, medium in available phosphorus, potassium and zinc. The experiment was comprised of four moisture conservation practices *viz.*, no mulch (M_1), wheat (M_2), mungbean (M_3) and mustard straw mulch (M_4) @ 5 t/ha (M_4) in main plots and four treatments of soil applied zinc @ 0 (Z_1), 2.5 (Z_2), 5.0 (Z_3) and 7.5 kg (Z_4) in sub plots. The experiment was laid out in split plot design with tree replication. The result revealed that the application of mungbean straw mulch @ 5 t/ha along with zinc @ 7.5 kg/ha (Z_4) recorded significantly higher quality parameters and yield as compared to control during both the years.

KEYWORDS: Moisture conservation practices, Zinc and Maize

Citation

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INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops belonging to the grassy family Poaceae with its origin as Central America. Maize is not only an important food crop for human nutrition, but also a basic element of animal feed and raw material for manufacture of many industrial products. Among the maize growing countries, India is 4th rank in the area and 7th rank in production. In world, India has 4% of the area and 2% of total production. At present, nearly 1147.7 million MT of maize is being produced together by over 170 countries from an area of 193.7 million ha with average productivity of 5.75 t/ha [1]. In India maize holds 3rd position in terms of area and production among the cereal crops. India occupies 9.5 million hectares area with production of 28.7 million tonnes with average productivity of 3032 kg/ha [2]. Over 70% of *kharif* maize area is grown under the rainfed condition with a prevalence of many biotic and abiotic stresses. The stress prone ecology contributes towards lower productivity of *kharif* maize (2706 kg/ha) as compared to *rabi* maize (4436 kg/ha), which is predominantly grown under assured ecosystem. Thus the major constraint for establishing a crop is the lack of adequate moisture. Apart from this, the productivity of maize is also limited due to moisture stress [3]. Moisture conservation practices have been widely used as an important management tool in which, application of organic residue helps in improving the proper growth and development of crops due to conserving the soil moisture and also enhanced the productivity of the crop [4]. Maize is the most vulnerable crop to zinc deficiency. Zinc plays a vital role in synthesis of chlorophyll, protein and helps in the utilization of nitrogen and phosphorous by plants as it acts an activator of dehydrogenase and proteinase enzymes, directly and indirectly in synthesis of carbohydrates and protein. Deficiency of zinc affects the yield and quality of crops over large areas of the world's cultivable land. Therefore, zinc supply and moisture conservation practices provide an opportunity to enhance fertility of soil, yield and productivity of crop.

1. MATERIALS AND METHODS

The field experiment was conducted at the Crop Research Centre (CRC), Main Campus of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) during *kharif* season 2020 and 2021. The soil of experimental field was sandy loam in texture, alkaline in reaction, low in available nitrogen (181.2 and 180.5 kg/ha) and organic carbon (0.33 and 0.35%), medium in available phosphorus (13.6 and 13.5 kg/ha), potassium (126.2 and 125.1 kg/ha) and zinc (0.704 and 0.715 mg/ha). The main-plot treatment consisted of 4 moisture conservation practices *viz*., no mulch, wheat, mungbean and mustard straw mulch @ 5 t/ha. The sub plots treatment also consisted of 4 doses of zinc application (kg/ha) in soil, namely 0, 2.5, 5.0 and 7.5 kg/ha. The maize variety Pioneer-3401 was used as a test crop which with a dose of 25 kg/ha sown in line mark at 60 cm row to row and 20 cm of plant to plant distance. A common dose of 150 kg N, 60 kg P_2O_5, and 60 kg K_2O/ha was applied in the form of urea, DAP and murate of potash, respectively. All other agronomic practices were applied equally to each experimental plot except mulching practices and zinc fertilizer during both the years. Three irrigations were applied to each treatment.

Protein content and yield

The crude protein content in maize grains were calculated by multiplying the nitrogen percentage in grains with a factor 6.25 [5] as,

Grains protein content (%) = Nitrogen content in grains (%) x 6.25

Protein yield was computed by using following formula:

$$\text{Protien yield (kg/ha)} = \frac{\text{Protein content (\%) x Grain yield (q/ha)}}{100}$$

Grain yield (t/ha)

Produce of net plot were sun dried threshed, cleaned and weighed in kilograms. The yield thus recorded was standardizing to 14% moisture and then converted into t/ha. A comprised diplomat sample of 500 g grains were taken and dried at 65 ± 2 ^{0}C in hot air drier to find out moisture content and do moisture adjustment accordingly.

Stover yield (t/ha)

The maize stalks of the net plot were cut close to the ground with the help of sickle and weight of stover obtained from the net plot area was recorded in kilograms. Finally, the stover yield was computed on hectare basis using the dry matter content on oven dry weight basis and expressed in t/ha.

2. RESULTS AND DISCUSSION

Quality parameters

Quality parameters *viz*., protein content (%) and protein yield significantly influenced by moisture conservation practices and soil applied zinc during both years. Among moisture conservation practices, application of mungbean straw mulch (M_3) @ 5 t/ha was recorded significantly maximum protein content (10.05 and 10.34 %) and protein yield (568.9 and 598.2 kg/ha) followed by mustard (M_4) and wheat straw mulch (M_2) during first and second year, respectively. Although, these treatments remained *on par* to each other produced significantly more quality parameters as compared to no mulch (M_1). However, the significantly lowest protein content (9.89 and 9.91%) and protein yield (436.3 and 447.5 kg/ha) was recorded with no mulch (M_1) during 2020 and 2021, respectively. In the current study, an enhancement in protein content was noted due to higher N content in grain, which is related to elevated nitrogen availability in the soil due to crop residue decomposition. Although, nitrogen is a fundamental component of amino acids, which form the basis of protein, increased nitrogen levels in the seed are directly responsible for higher protein levels. These results are in agreement with the findings of [6] and [7].

Soil applied zinc (kg/ha) caused significant variation in protein content (%) and protein yield (kg/ha) in maize during both the years. The average protein content and protein yield varied from 9.78 and 10.00 to 10.11 and 10.30, 458.9 and 582.6to 483.5 and 603.1 kg/ha, respectively, being highest with the application of zinc @ 7.5 kg (Z_4) followed by 5.0 kg zinc (Z_3) during both the years. Although, these treatments remained *on par* to each other produces significantly more protein content and protein yield as compared to control (Z_1) and 2.5 kg (Z_2) during both the years. However, the lowest protein content and protein yield was recorded with control (Z_1) during both the years. The improvement in protein content and yield by zinc ascribed to the role of Zn in nitrogen metabolism and protein synthesis. [8, 9] were also reported similar findings.

Yield

It is obvious from the data that the moisture conservation practices affected the grain and stover yield significantly during both the years. The highest grain (5.66 and 5.78 t/ha) and stover yield (9.82 and 9.96 t/ha) was recorded under mungbean straw mulch (M_3) which was *on par* with mustard (M_4) and wheat straw mulch (M_2) and significantly superior over no mulch (M_1) during both the years. However, the minimum grain (4.41 and 4.52 t/ha) and stover yield (7.93 and 8.05 t/ha) was recorded in

no mulch (M_1) during first and second year, respectively. Grain and stover yield with mungbean straw mulch (M_3) increased to the tune of 22.1 to 21.8% and 19.2 to19.2% more than no mulch (M_1) during 2020 and 2021, respectively. The increased grain yield with mungbean straw mulch could be attributed to increased moisture availability and the addition of organic matter. Rapid decomposition of organic residues increased the nutrient availability, leading to an improvement in growth and yield attributes, better translocation of photosynthates toward sink and source ultimately grain and stover yield/ha. Our results are in close conformity with those of [10, 11]

Among soil applied zinc (kg/ha), significantly maximum grain (5.76 and 5.85 t/ha) and stover yield (9.88 and 9.97 t/ha) was recorded with the application of zinc @ 7.5 kg (Z_4), being *on par* with 5.0 kg zinc (Z_3) and significantly superior over rest of the treatments during both the years. Although during both the years, 2.5 kg (Z_2) was also significant over control. While, the minimum grain (4.69 and 4.83 t/ha) and stover yield (8.55 and 8.70 t/ha) was recorded under control (Z_1) during both the years. Soil applied zinc @ 7.5 kg (Z_4) out yielded the control by 18.6 and 17.4% (grain yield) and 13.5 and 12.7% (stover yield) during first and second year, respectively. The improvement in the yield attributing characters might be due to the role of zinc in biosynthesis of indole acetic acid (IAA) and especially due to its role in initiation of primordia for reproductive parts and partitioning of photosynthates towards them developing (sink), which resulted in better flowering and fruiting [12]. Similar findings were also reported by [13, 1].

Table 1: Effect of moisture conservation practices and soil applied zinc on yield and quality parameters of maize during 2020 and 2021

Treatments	Grain yield (t/ha)		Stover yield (t/ha)		Protein content (%)		Protein yield Kg/ha	
	2020	2021	2020	2021	2020	2021	2020	2021
Moisture conservation practices (Straw mulch @ 5 t/ha)								
M_1-No mulch	4.41	4.52	7.93	8.05	9.89	9.91	436.3	447.5
M_2-Wheat	5.44	5.54	9.64	9.73	9.92	10.17	540.6	564.0
M_3-Mungbean	5.66	5.78	9.82	9.96	10.05	10.34	568.9	598.2
M_4-Mustard	5.56	5.68	9.81	9.95	9.98	10.19	555.4	578.7
SEm±	0.11	0.12	0.18	0.20	0.03	0.05	10.6	10.1
CD (P=0.05)	0.37	0.40	0.64	0.70	0.11	0.19	36.7	34.8
Soil applied Zinc (kg/ha)								
Z_1-0	4.69	4.83	8.55	8.70	9.78	10.00	458.9	483.5
Z_2-2.5	5.06	5.18	9.07	9.21	9.91	10.11	501.2	524.0
Z_3-5.0	5.56	5.65	9.70	9.81	10.05	10.20	558.6	577.8
Z_4-7.5	5.76	5.85	9.88	9.97	10.11	10.30	582.6	603.1
SEm±	0.10	0.10	0.18	0.16	0.06	0.05	10.0	9.7
CD (P=0.05)	0.29	0.28	0.51	0.45	0.17	0.13	29.2	28.3

3. CONCLUSION

On the basis of two-year experimentation it may be concluded that the application of mungbean or mustard straw mulch @ 5.0 t/ha along with basal application of zinc @ 5.0 to 7.5 kg/ha recorded significantly higher protein content, protein yield and yield (grains + stover) may be recommended for

getting higher protein content, protein yield and yield of maize under limited moisture conditions of semi-arid areas of western U.P.

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S.No 126

Temperature Monitoring System Using Internet of Things

Apranjal Singh* and Vineeta Verma**

Abstract

In this scenario, practically in all and every way, we want to that life has become very needful simpler and easier as in all ways of automation technology has progressed. In today's automation world, automatic operating systems are very much preferred over huge ways of technology and also manual ones. With the tremendous growth in the number of internet users over the last decade, the internet has become a way of life, and IoT is the most recent internet technology to emerge in today's society. The Internet of Things (IoT) is a growing network of common objects that allows everything from industrial machines to consumer goods to share data and accomplish tasks while you are busy with other things. IoT is a technology that uses computers or mobile devices to control basic home functions and features from anywhere in the world via the internet. This work uses a Raspberry Pi with a Linux operating system and a C++ programs to get temperature measurements, which are then sensed and communicated to the internet.

Keywords: Raspberry pi, IoT, Temperature sensor and monitoring system.

INTRODUCTION

Several technologies [1] for industrial automation have already been introduced. Recently established network connectivity options such as Ethernet, Wireless LAN, and others have been utilised in industrial applications in recent years. In previously established approaches, there are an infinite number of additional automation alternatives.We can do the programme according to our demands with the help of many software programmes available. Software programmes can change or modify data processing."The use of arduino with the help of Ethernet boards for Ethernet expansions is common in IoT projects, but the problem is that the communication between the Ethernet shield and the arduino takes place through SPI buses, and some of the digital pins are used when an arduino is connected to an Ethernet shield and if one of the pins is broken, the programme is terminated." Furthermore, troubleshooting software faults is tough, and once the W5100 begins to heat up, the arduino's Micro controller tends to restart again and over.Because an arduino cannot run many programmes at the same time, a raspberry pi is the greatest solution for extending internet access and is thus frequently utilised for IoT. To view the temperature recordings, a web app or a mobile app can be created.

Temperature measurement is one of the most popular techniques utilised because it is necessary for many activities and tasks to be completed, such as in any industry that uses heaters, where a certain temperature is required.When it comes to temperature sensing, a temperature sensor is utilised, which is put at the location where the temperature is to be measured. The temperature of that location can be monitored via the internet of things.

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Temperature, pressure, flow rate, capacity, acceleration, and other variables are all monitored in diverse applications. There are various monitoring methods for acquiring measurements depending on the amounts, dispersion, and detected frequency of the monitored items Several issues commonly arise throughout the process of monitoring a room's temperature. For example, to monitor a temperature in a server room, the temperature must be regulated between 15 and 20^{0}C, otherwise the server may crash, resulting in a loss of hundreds of thousands of dollars Management must decide whether to hire a person to monitor the temperature or design a system that can monitor the temperature from multiple locations at any given time

To address the issue "a web-based temperature monitoring system is being developed which can be accessed from anywhere and at any time via the Internet This device allows a user to remotely monitor the room temperature from afar, perhaps saving money on human labour IoTbased Temperature Monitoring is a sort of temperature recorder that monitors a room's temperature records the information in a database, and displays the current temperature on a website via a webserver The device will continuously monitor the room's temperature, and the data may be viewed at any time and from any location over the Internet.Temperature monitoring is widely utilised in a variety of activities, including automotive, air conditioning, power plants, and other industries that require data storage and analysis." This system model's major goal is to make it simple for the user to see the current temperature

LITERATURE REVIEW

A real-time remote monitoring with data acquisition system consisting of a DHT11 temperature sensor, Atmel Atmega 2560 microprocessor, and GSM/GPRS that were connected to the web server has been proposed and discussed for use in many domains ranging from health, agriculture, environmental monitoring to remote automation in various industries [2].However [3-4] just created the system to test the device's functionality, and no further analysis of the data was done

In the agriculture industry, "the IoT Cloud-based Framework has gained popularity by allowing the monitoring of farms using low-cost devices that may cover a large area utilising GSM/GPRS, ZigBee, or MQTT [5-7] The data centre temperature monitoring is another sector where the IoT Cloud-based Framework has been employed [8]. In [4, 7], authorsutilised a Platform-as-a-Service (PaaS) IoT platform, such as AT&T M2X and Losant, to store and analyse their data, whilst the others created their own data server The ZigBee protocol has been widely utilised in many research since it has been shown to be efficient, lightweight, and low-power" [10-12].

In [9, 10], authorsutilised"the microcontroller Arduino Board range to connect to the internet via either Ethernet, ZigBee, or GSM/GPRS shield to satisfy the low-cost development need.Texas Instruments' TI CC3200 LaunchPad Board and TI CC2530 board, on the other hand, integrated a SimpleLink Wi-Fi module and an RF Solution-on-Chip for connectivity, making them suited for usage primarily inside [4, 7]. NodeMCU, an open source IoT platform based on the ESP8266 Wi-Fi SoC with complete TCP/IP stack, is another option" [13, 14].

In [5], authors used "a Sensirion SHT15 sensor to monitor temperature in agriculture, which can measure temperatures from -40°C to 123.8°C. The SHT11 temperature sensor from the same family was also utilised [3, 12], where the humidity measurement was computed based on the temperature data.In [10], authorsutilised a fibre optic sensor to detect the temperature of a liquefied petroleum storage tank because it is insensitive to electromagnetic interference and is built of a glass construction that can withstand very high temperatures. In[4, 8], authorsutilised formulae based on the analogue voltage output of the HRT393 and Arduino to measure relative humidity and temperature using integrated sensors HRT393 and LM335A, respectively." Meanwhile [12] compared the data

from a number of temperature and humidity sensors, including the DHT11, Grove Temp, BMP085, and DS18B20.

The contemporary data centre has "encountered problems in the era of big data, when billions of devices are connected to the internet and to one other, putting growing pressure on IT departments to handle data that is instantly available to end users. The goal of focusing on energy efficiency and cooling innovation is to lower operating costs. Because data centre components are mostly made up of electrical and mechanical parts, prolonged exposure to high temperatures can lead to problems [15] In order to provide ideal working conditions in a data centre, a good room layout design with an appropriate cooling system is required. However, some businesses miss this crucial factor, resulting in a costly expense to redesign the space arrangement. The implementation of a temperature monitoring system, as suggested by [16], to prevent server shutdown due to overheating, can avoid scenarios where IT personnel walked into the data centre on Monday morning after the weekend and discovered that the air conditioning was off due to a power outage or malfunction".

Temperature monitoring in the data centre is "critical since overheated equipment has a shorter lifespan and is more likely to break unexpectedly in the future, even if the air conditioning is working well. Furthermore, if the temperature is too cold, humidity will rise in relation to the temperature, creating corrosion on the equipment or condensation that might harm the equipment. If the temperature is too high, lowering the humidity causes static build-up, which can cause equipment damage. Cooling the data centre extensively was one of the methods formerly utilised to prevent server overheating [16]." However, this technique will result in an excessive usage of electricity, increasing the data center's energy consumption.

The temperature range of "the server intake may be maintained at 18–27°C using a monitoring system [17]. Providing human resources to constantly monitor the temperature and humidity of the data centre, on the other hand, is unrealistic and may raise the cost of human resources. Periodic monitoring by IT employees, which is standard practise, necessitates regular physical access to the data centre, thereby increasing the risk of threats such as static buildup, theft, equipment sabotage, and unauthorised access. Without automated monitoring, IT staff may be unaware of any temperature rises in the data centre, particularly over the weekend or during an extended vacation. The most inexpensive real-time monitoring solution on the market today is quite pricey, and even if it is, it has limited capabilities. "Most systems are vendor-specific, with additional fees for features such as warning alerts, notifications, and additional sensors.

Smart homes, "smart cities, asset monitoring and inventory control, shipping and location, medical devices, security, individual tracking, and energy saving are just a few examples of IoT applications. As previously said, the Internet of Things (IoT) enables device-to-device communication, also known as Machine-to-Machine (M2M) connectivity. Physical equipment can communicate with individuals in this way, informing them of their status and where it is. Trucks and ships, for example, allow the maximum capacity to be filled to the devices by communicating among devices and then transmitting that information to a person who may profit on the information supplied.All of these technologies work together to increase revenue by lowering the cost of incapability in the firm. Automated temperature control using LabVIEW and a PWM system with a transistor controlled by a relay are two examples" of existing methods.

Automated Temperature Control Using Lab View

The reading of the temperature value from "the LM35 temperature sensor is the principal item in the temperature system. The major application of the LM35 temperature sensor is that it is the

most basic of all temperature sensors, with an integrated circuit that outputs a voltage proportional to the temperature in degrees Celsius and the non-linear effects are dealt with by the sensor itself. The LM35 sensor is directly linked to the DAQ system." The signal from the LM35 sensor is received by LabVIEW as a variable analogue value. LabVIEW will send a cooling or heating signal to the system after processing.

Using a PWM System with a Transistor, Operated with a Relay

The air conditioning in the residence is controlled by a relay. To switch on or off the relevant relay, a transistor is used. The PWM system is used to regulate the heating and cooling equipment in the temperature system programming process. The LM35 sensor is powered by a 5V DC power supply.TIP41transistor has the capacity to turn on/off for many pulses in a short amount of time at its base. The temperature sensor is an LM35. The voltage signal from the LM35 sensor is interpreted as a changeable analogue value by LabVIEW when it is directly linked to the DAQ.Depending on the value of the sensor and the crucial temperature value that is required, LabVIEW will send a signal as cooling or heating to the system after processing the structure in the programme. In the temperature control system's programming method.

Other than NI modules like the NI Rio and other devices in its class, connecting the LabVIEW software to other interfacing devices like as the raspberry pi, arduino, or beagle bone black might provide a number of problems.Although connecting the lab VIEW to the Arduino is possible, interfacing this device is a difficult task. Establishing a connection to the IoT cloud of many open source organisations, such as IBM Watson, Amazon AWS, and others, is a time-consuming task because the IP address and physical address of the measuring component must be determined or traced.Furthermore, many cloud services can only interact through the MQTT protocol, which necessitates the installation of additional MQTT for Arduino packages. A Raspberry Pi can't run any LabVIEWprogrammes, but it's the greatest option for IoT.

This paper describes how the Raspberry Pi may be used to monitor and manage temperature while also being linked to the Internet of Things. If the gadget is connected to the IoT, the data may be accessed as well. The goal of this research is to create a real-time temperature monitoring system that can be developed and deployed quickly using the IoT platform.

METHODOLOGY

Raspberry pi with internet connectivity. Temperature sensor are the main hardware of this system. It is easy to operate and is cost effective and consumes low power. The monitored data is collected at the Web server with perfect date and time. The design of the system is done in such a way that system can work 24x7 and give exact data of temperature on real time basis. Figure 1 shows the block diagram of proposed model.

Raspberry Pi is "small size minicomputer used to do small computing and networking operations which can be done by a computer system. Also, it provides GPIO pins due which it becomes the main element in the field of internet of things. It provides access to the internet using wires or wireless connectivity and hence automation of various systems of different devices with remote location becomes possible. Raspberry pi is available in various versions, here we used Raspberry Pi 3 model B, it has a 1.2 GHz 64-bitquad core ARMv8 CPU, and RAM of 1GB. it also has 40 GPIO pins, Full HDMI port, 4 USB ports, Ethernet port, 802.11n wireless LAN connectivity, Bluetooth 4.1 connectivity, Bluetooth low energy, 3.5mm audio jack, video Camera interface (CSI), the Display interface (DSI), and Micro SD card slot".

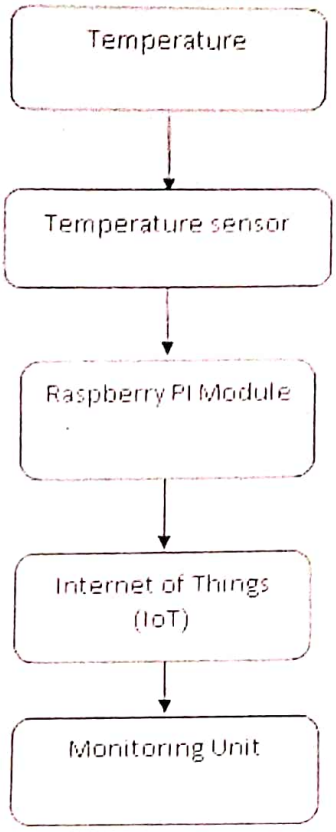

Figure 1: Block diagram of proposed model

RESULTS

The raspberry pi first checks the internet connection, if there is no persistence of internet connectivity, then the execution of the raspberry pi will be terminated. If the Rpi. is connected the internet the execution of the program will be done automatically. The temperature and the humidity parameters, are measured and sent to the internet cloud for every 20 seconds and the parameters are sensed and sent to the cloud Figure 2 shows the implemented system of IoT based temperature monitoring system

Qt Creator adds support for developing and executing Qt applications on desktop platforms such as Windows, Linux, and mobile platforms such as Android.The code that is written in the QT creator, retrieves the data from the DHT11 sensor that will be sent to the Internet. In this paper, unlike the usage of open source cloud data base services like IBM or Amazon AWS services, an SQL data base is created, where in which the tables are created as per the requirements and the data is stored in there enabling us to surf through the archived data too The corresponding mobile app is created, that shows the same data as in the web app. A Wi-Fi dongle is used for the internet connectivity of the raspberry pi. Figure 3 shows the mobile app, indicating the measured parameters

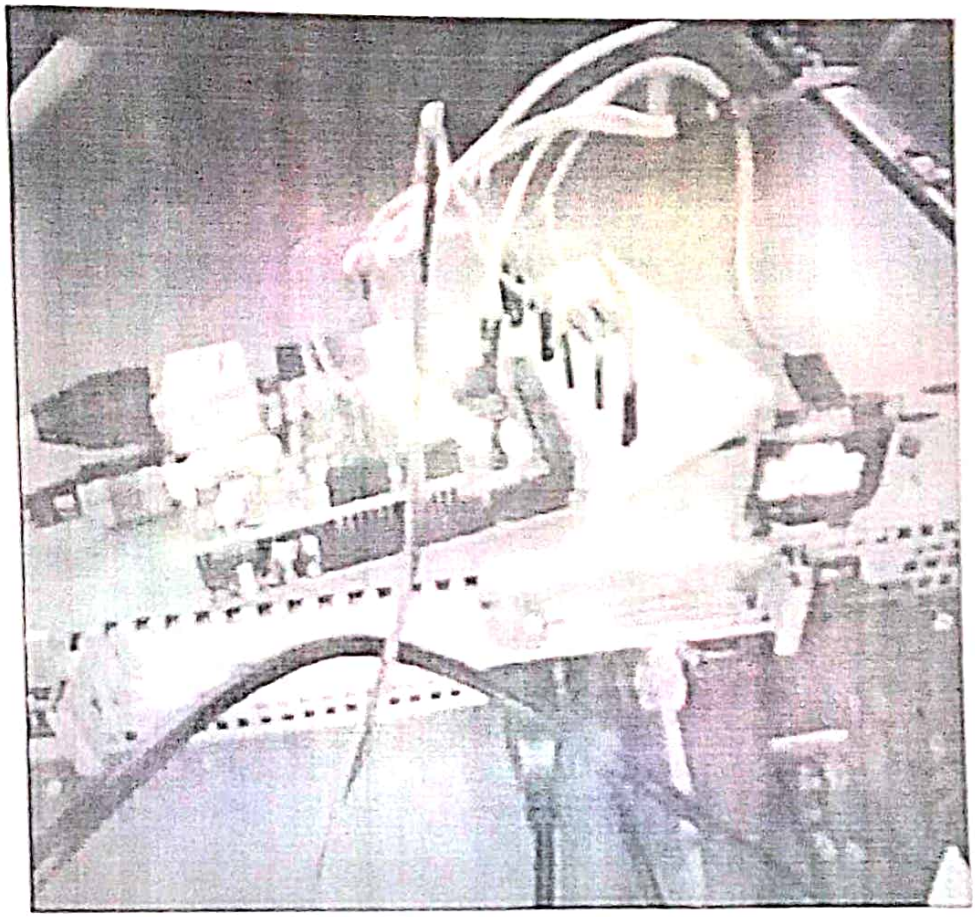

Figure 2: Implemented system

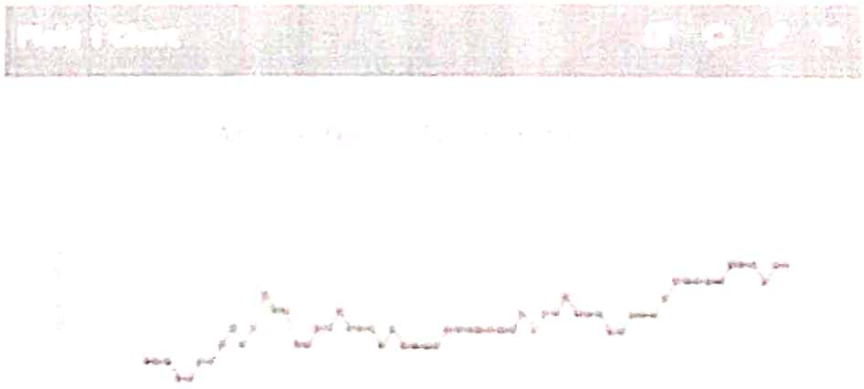

Figure 3: Mobile app, indicating the measuredparameters

CONCLUSION

Temperature control is critical in a variety of applications, including food and beverage manufacturing, textile manufacturing, machinery manufacturing, chemical manufacturing, agricultural manufacturing, and healthcare manufacturing. The administrator will find that collecting and analysing sensor data via the Internet is a simple task.We propose a new scheme of residential temperature monitoring system based on the current state of development using IoT platform. The monitoring hardware consists of a Raspberry Pi, a Wi-Fi dongle, a DHT 11 sensor, and an Android phone. The automated temperature monitoring is the subject of this study The findings indicate that the proposed system is feasible. At the same time, it lowers the cost of the monitoring system.

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Certain Finite Product Formulas Involving Double Hypergeometric Functions of EXTON and KAMPÉ DE FERIÉT

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ABSTRACT

The aim of the present paper is to obtain certain finite product formulas involving double hypergeometric functions of Exton and Kampé de Fériet, by using some series rearrangement techniques and applying well-known Ramville's theorem for generating function.

2010 Mathematics Subject Classification: 33C05, 33C20, 33C65, 33C70.

Keywords and Phrases: Pochhammer's symbol; Series rearrangement technique, Generating function; Double and triple hypergeometric functions; Multiplication formulae.

1. INTRODUCTION: A BRIEF SURVEY

Kampé de Fériet[13,p.63(16)] established the double hypergeometric series in 1921, which is the unification and generalization of Appell's four double hypergeometric functions F_1, F_2, F_3, F_4 [13,p.53(4.5.6.7)] and its seven confluent forms $\Phi_1, \Phi_2, \Phi_3, \Psi_1, \Psi_2, \Xi_1, \Xi_2$[13,p.58(36.37),p.59(40.41.42.43.44)].

Later Srivastava and Panda[11,p.123(26); see also 15,p.23 (1.2.1.3)] defined the general double hypergeometric function of Kampé de Fériet in terms of slightly revamped notation as :

$$F_{l:m:n}^{p:q:r}\left[\begin{matrix}(p_p):(q_q):(r_r) & : \\ (l_l):(u_m):(v_n) & :\end{matrix}\; y,\; z\right] = \sum_{i,j=0}^{\infty} \frac{[(p_p)]_{i+j}\,[(q_q)]_i\,[(r_r)]_j\; y^i\, z^j}{[(l_l)]_{i+j}\,[(u_m)]_i\,[(v_n)]_j\; i!\; j!} \qquad (1.1)$$

Srivastava[10,p.128] described the triple hypergeometric series in 1967 as:

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$$F^{(3)}\left[\begin{array}{l}(a_A)::(b_B):\ (d_D):\ (e_E):(g_G):\ (h_H):\ (k_K):\\ \\ (\ell_L)::(m_M):\ (n_N):\ (p_P):(q_Q):\ (r_R):\ (t_T):\end{array}\ \begin{array}{l}\\ \\ x,\ y,\ z\end{array}\right]$$

$$=\sum_{u,v,w=0}^{\infty}\frac{[(a_A)]_{u+v+w}\,[(b_B)]_{u+v}\,[(d_D)]_{v+w}\,[(e_E)]_{w+u}\,[(g_G)]_u\,[(h_H)]_v\,[(k_K)]_w\,x^u\,y^v\,z^w}{[(\ell_L)]_{u+v+w}\,[(m_M)]_{u+v}\,[(n_N)]_{v+w}\,[(p_P)]_{w+u}\,[(q_Q)]_u\,[(r_R)]_v\,[(t_T)]_w\,u!\,v!\,w!}\qquad(1.2)$$

which is the extensive amalgamation and generalization of Lauricella's all fourteen triple hypergeometric functions of second order $F_1,\ F_2,\ F_3,\ \cdots,\ F_{14}$[3.pp.113-114] including Saran's ten triple hypergeometric functions $F_E,\ F_F,\ F_G,\ F_K,\ F_M,\ F_N,\ F_P,\ F_R,\ F_S,\ F_T$[13. pp.66-68(26-35)], extended triple hypergeometric function F_K of Sharma 5.p.613(2)] as well as three additional triple hypergeometric functions $H_A,\ H_B,\ H_C$ of Srivastava[8.9].

Also in 1982, Horn's non confluent double hypergeometric function H_4[13:p.57(28)] and Horn's confluent double hypergeometric function H_7[13.p.58. were generalized and merged by Exton[2.p.137(1.2)] , as the following double hypergeometric series:

$$X_{T:A}^{P:Q:R}\left[\begin{array}{l}(p_P):(q_Q);(r_R)\ \ ;\\ \\ (t_T):(u_U);(v_V)\ \ ;\end{array}\ \begin{array}{l}\\ \\ y,\ z\end{array}\right]=\sum_{i,j=0}^{\infty}\frac{[(p_P)]_{2i+j}\,[(q_Q)]_i\,[(r_R)]_j\,y^i\,z^j}{[(t_T)]_{2i+j}\,[(u_U)]_i\,[(v_V)]_j\,i!\,j!}\qquad(1.3)$$

For easy reference the symbol (p_P) represents the array of P parameters given by $p_1, p_2, p_3, \cdots, p_P$ in the contracted notation due to Slater[6.p.54:7.p.41], while the notation $\Delta(M:a)$ stands for the array of M parameters $(M>1)$ given by $(a)/M,\ (a+1)/M,\ (a+2)/M,\ \cdots,\ (a+M-1)/M$. Also The symbol $\Delta[M:(p_P)]$ represents the array of MP parameters given by $(p_1)/M,\ (p_1+1)/M,\ (p_1+2)/M,\ \cdots,\ (p_1+M-1)/M,\ (p_2)/M,\ (p_2+1)/M,\ (p_2+2)/M,\ \cdots,\ (p_2+M-1)/M,\ \cdots(p_P)/M,\ (p_P+1)/M,\ (p_P+2)/M,\ \cdots,\ (p_P+M-1)/M$.

The asterisk in $\Delta^*(M:j+1)$ evidences the fact that the (denominator) parameter M/M obtained from $\Delta(M:j+1)$ is always excluded if $0\leq\ j\ \leq(M-1)$ so that the set $\Delta^*(M:j+1)$ is evidently left with only $(M-1)$ parameters.

The notation $[(b_B)]_m$ is known as Pochhammer's symbol or generalized factorial function and is defined as:

$$[(b_B)]_m = \prod_{n=1}^{B}\{(b_n)_m\} = \begin{cases} \prod_{n=1}^{B}\left\{\frac{\Gamma(b_n+m)}{\Gamma(b_n)}\right\} : \text{if } b_n \neq 0, -1, -2, \cdots \\ \prod_{n=1}^{B}\{(b_n)(b_n+1)(b_n+2)\cdots(b_n+m-1)\} : \text{if } m = 1, 2, 3, \cdots \end{cases} \tag{1.4}$$

where the notation Γ represents Gamma function and other symbols have their usual meanings.

2. USEFUL IDENTITIES AND FORMULAE

In section 4, to derive finite product formulae (3.1) and (3.2) we shall use the following series manipulation formulas and (2.20). Also other formulae given under will serve the purpose, directly or indirectly.

$$\sum_{n=0}^{\infty}\sum_{p=0}^{\infty}\Phi(n,p) = \sum_{i=0}^{2M-1}\sum_{j=0}^{1}\sum_{n=0}^{\infty}\sum_{p=0}^{\infty}\Phi(2Mn+i, 2p+j) \tag{2.1}$$

which is the special case of the following series identity due to Srivastava[10,p.193(8), p.196(23); see also 11,p.214(8),p.217(12)]

$$\sum_{n=0}^{\infty}\sum_{m=0}^{\infty}\Phi(n,m) = \sum_{i=0}^{N-1}\sum_{k=0}^{M-1}\sum_{n=0}^{\infty}\sum_{m=0}^{\infty}\Phi(nN+i, mM-k) \tag{2.2}$$

$$\sum_{n=0}^{\infty}\Psi(n) = \sum_{i=0}^{M-1}\sum_{n=0}^{\infty}\Psi(nM+i) \tag{2.3}$$

$$\sum_{u=0}^{\infty}\sum_{v=0}^{u}\Xi(u,v) = \sum_{u=0}^{\infty}\sum_{v=0}^{\infty}\Xi(u+v, v) \tag{2.4}$$

$$(b)_{-m} = \frac{\Gamma(b-m)}{\Gamma(b)} = \frac{(-1)^m}{(1-b)_m} \tag{2.5}$$

where $b \neq 0, \pm1, \pm2, \pm3, \pm4, \ldots$ and $m = 1, 2, 3, 4, \ldots$

$$(a)_{M+N} = (a)_M\,(a+M)_N$$

$$(a)_{M-N} = \frac{(-1)^N\,(a)_M}{(1-a-M)_N};\ M \geq N \geq 0 \tag{2.6}$$

$$[(b_B)]_{M+N} = [(b_B)]_M[(b_B)+M]_N \tag{2.7}$$

$$(M-N)! = (1)_{M-N} = (1)_M(1+M)_{-N} = \frac{(-1)^N\,M!}{(-M)_N},\ 0 \leq N \leq M \tag{2.8}$$

$$[(k_K)+m]_{-s} = \frac{(-1)^{Ks}}{[1-(k_K)-m]_s} \tag{2.9}$$

(2.10)

$$(a)_{MN} = M^{MN} \prod_{j=1}^{M} \left\{ \left(\frac{a+j-1}{M} \right)_N \right\} \tag{2.11}$$

$$[(b_B)]_{MN} = M^{MNB} \prod_{j=1}^{M} \left\{ \left[\frac{(b_B)+j-1}{M} \right]_N \right\} \tag{2.12}$$

$${}_1F_0 \left[\begin{matrix} a & ; \\ - & ; \end{matrix} x \right] = (1-x)^{-a} = \sum_{n=0}^{\infty} \frac{(a)_n x^n}{n!} \; ; |x| < 1 \tag{2.13}$$

The identities (2.8) and (2.12) can be established in accordance with the definition of Pochhammer's symbol (1.4), (2.6) and (2.11).

We recall the following theorem on generating function given by Rainville[3.p.137(Th.48)]:

If $P(v)$ refers a formal power series expansion in v

$$P(v) = \sum_{n=0}^{\infty} B_n \, v^n \; ; \; B_0 \neq 0 \tag{2.14}$$

and

$$(1-\zeta)^{-a} P\left[\frac{-4\zeta t}{(1-\zeta)^2} \right] = \sum_{m=0}^{\infty} G_m(t) \, \zeta^m \tag{2.15}$$

then

$$t^m = \frac{(a)_{2m}}{2^{2m} \, B_m} \sum_{n=0}^{m} \frac{(-1)^n (a+2n) G_n(t)}{(m-n)! \, (a)_{n+m+1}} \tag{2.16}$$

If we consider

$$G_m(t) = \frac{(a)_m}{m!} \, {}_{2+A}F_E \left[\begin{matrix} -m, a+m, (a_A) & ; \\ (e_E) & ; \end{matrix} t \right]. \tag{2.17}$$

then by using series rearrangement technique, we can prove that:

$$\sum_{m=0}^{\infty} G_m(t) \, \zeta^m = (1-\zeta)^{-a} \sum_{n=0}^{\infty} \frac{(\frac{a}{2})_n (\frac{a+1}{2})_n [(a_A)]_n}{n! \, [(e_E)]_n} \left[\frac{-4\zeta t}{(1-\zeta)^2} \right]^n$$

$$= (1-\zeta)^{-a} \sum_{n=0}^{\infty} B_n \left[\frac{-4\zeta t}{(1-\zeta)^2} \right]^n$$

$$= (1-\zeta)^{-a} P\left[\frac{-4\zeta t}{(1-\zeta)^2} \right] \tag{2.18}$$

$$(a)_{MN} = M^{MN} \prod_{j=1}^{M} \left\{ \left(\frac{a+j-1}{M} \right)_N \right\} \tag{2.11}$$

$$\{(b_B)\}_{MN} = M^{MNB} \prod_{j=1}^{M} \left\{ \left[\frac{(b_B)+j-1}{M} \right]_N \right\} \tag{2.12}$$

$${}_1F_0 \left[\begin{matrix} a & ; \\ - & ; \end{matrix} x \right] = (1-x)^{-a} = \sum_{n=0}^{\infty} \frac{(a)_n \, x^n}{n!} \; ; |x| < 1 \tag{2.13}$$

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$$P(v) = \sum_{n=0}^{\infty} B_n \, v^n \; : \; B_0 \neq 0 \tag{2.14}$$

and

$$(1-\zeta)^{-a} P\left[\frac{-4\zeta t}{(1-\zeta)^2} \right] = \sum_{m=0}^{\infty} G_m(t) \, \zeta^m \tag{2.15}$$

then

$$t^m = \frac{(a)_{2m}}{2^{2m} \, B_m} \sum_{n=0}^{m} \frac{(-1)^n (a+2n) G_n(t)}{(m-n)! \, (a)_{n+m+1}} \tag{2.16}$$

If we consider

$$G_m(t) = \frac{(a)_m}{m!} \, {}_{2+A}F_E \left[\begin{matrix} -m, a+m, (a_A) & ; \\ (c_E) & ; \end{matrix} t \right], \tag{2.17}$$

then by using series rearrangement technique, we can prove that:

$$\begin{aligned} \sum_{m=0}^{\infty} G_m(t) \, \zeta^m &= (1-\zeta)^{-a} \sum_{n=0}^{\infty} \frac{\left(\frac{a}{2}\right)_n \left(\frac{a+1}{2}\right)_n [(a_A)]_n}{n! \, [(c_E)]_n} \left[\frac{-4\zeta t}{(1-\zeta)^2} \right]^n \\ &= (1-\zeta)^{-a} \sum_{n=0}^{\infty} B_n \left[\frac{-4\zeta t}{(1-\zeta)^2} \right]^n \\ &= (1-\zeta)^{-a} P\left[\frac{-4\zeta t}{(1-\zeta)^2} \right] \end{aligned} \tag{2.18}$$

where

$$B_n = \frac{(\frac{\alpha}{2})_n(\frac{\alpha+1}{2})_n[(a_A)]_n}{n!\ [(e_E)]_n} \tag{2.19}$$

Use of $G_m(t)$ and B_n (given by (2.4) and (2.6) respectively), in the relation (2.3) yields:

$$\frac{t^m[(a_A)]_m}{m!\ [(c_E)]_m} = \sum_{n=0}^{m} \frac{(-1)^n\ (\alpha - 2n)\ (\alpha)_n}{(m-n)!\ (\alpha)_{n-m+1}\ n!}\ {}_{A-2}F_E \left[\begin{matrix} -n,\ \alpha + n,\ (a_A) & ; \\ & t \\ (c_E) & ; \end{matrix} \right] \tag{2.20}$$

where ${}_{A-2}F_E$ is generalized hypergeometric polynomial of one variable[6,p.41(2.1.1.3)].

3. MAIN PRODUCT FORMULAS

If arguments and parameters both are suitably regulated in such a manner that the each and every term of evolving power series is entirely meaningful and elucidated then without sacrificing convergence, we have

$$(1-\zeta t)^{-a}\ F_{E:G:H}^{A+M:B:D} \left[\begin{matrix} \Delta(M:a),\ (a_A): (b_B)\ ;\ (d_D) & : & \\ & & \frac{x}{(1-\zeta t)^M},\ \frac{y}{(1-\zeta t)^M} \\ (e_E) \quad : (g_G)\ ;\ (h_H) & ; & \end{matrix} \right]$$

$$= \sum_{p=0}^{\infty} \sum_{q=0}^{M-1} \frac{(a)_{p+q}[(k_K)]_{p-q}(-1)^p\ \zeta^{p+q}}{[(l_L)]_{p+q}\ (c-p)_p(c+2p+1)_q\ p!\ q!}\ {}_{L-2}F_K \left[\begin{matrix} -p,\ c+p,\ (l_L) & : & \\ & & t \\ (k_K) & : & \end{matrix} \right] \times$$

$$\times F^{(3)} \left[\begin{matrix} \Delta(M:a+p+q):: - ;\ (a_A) ;\ - : \\ \\ - :: - ;\ (c_E) ;\ - : \end{matrix} \right.$$

$$\left. \begin{matrix} \Delta[M:(k_K)+p+q] ;\ (b_B) ;\ (d_D) ; & \\ \Delta[M:(l_L)+p+q,\ \Delta^*(M:q+1),\ \Delta(M:c+2p+q+1) ;\ (g_G) ;\ (h_H) ; & \frac{\zeta^M}{M^{M(L-K+1)}},\ x,\ y \end{matrix} \right] \tag{3.1}$$

$$(1-\zeta t)^{-b}\ X_{D:G:L}^{B+N:E:H} \left[\begin{matrix} \Delta(M:a),\ (b_B): (e_E);\ (h_H) & ; & \\ & & \frac{x}{(1-\zeta t)^{2M}},\ \frac{y}{(1-\zeta t)^M} \\ (d_D) \ : (g_G)\ ;\ (l_L) & ; & \end{matrix} \right]$$

$$= \sum_{p=0}^{\infty} \sum_{q=0}^{2M-1} \sum_{r=0}^{1} \frac{(-1)^p\ \zeta^{p+q}}{r!\ q!\ p!} \left(\frac{y}{M^M} \right)^r \frac{(a)_{p+Mr+q}}{(c+p)_r\ (c+2p+1)_q} \frac{(b_B)_r(h_H)_r[(k_K)]_{p+q}}{[(d_D)]_r[(l_L)]_r[(a_A)]_{p+q}} \times$$

$$\times {}_{A+2}F_K\left[\begin{array}{ll} -p,\ c+p,\ (a_A) & ; \\ & t \\ (k_K) & ; \end{array}\right] F^{(3)}\left[\begin{array}{l} \Delta(2M:a+p+Mr+q):: - \ ;\ \Delta[2:(b_B)+r] \ ; \\ \\ - :: - \ ;\ \Delta[2:(d_D)+r] \ ; \end{array}\right.$$

$$- : \Delta[2M;(k_K)+p+q] \ ; (e_E) \ ;$$

$$- : \Delta[2M;(a_A)+p+q], \Delta^*(2M:q+1), \Delta(2M:c-2p+q+1) \ ; (g_G) \ ;$$

$$\left.\begin{array}{l} \Delta[2:(h_H)+r] \ ; \\ \\ \Delta[2:(\ell_L)+r], \Delta^*(2:1+r) \ ; \end{array}\right. \left.\begin{array}{l} \\ \\ \frac{\zeta^{2M}}{(2M)^{2M(1+A-K)}}, \ \frac{x}{\Gamma(D-B-M)}, \ \frac{y^2}{\Gamma(D+L-1-B-M-H)} \end{array}\right] \qquad (3.2)$$

4. DERIVATIONS OF (3.1) AND (3.2)

The left hand side of (3.1) can be represented in terms of its power series as:

$$(1-\zeta t)^{-a} \ F_{E:G:H}^{A+M:B:D}\left[\begin{array}{ll} \Delta(M:a),\ (a_A):(b_B) \ ; (d_D) & ; \\ & \frac{x}{(1-\zeta t)^M}, \ \frac{y}{(1-\zeta t)^M} \\ (e_E) \qquad : (g_G) \ ; (h_H) & ; \end{array}\right]$$

$$= \sum_{i=0}^{\infty}\sum_{j=0}^{\infty} \frac{(\frac{a}{M})_{i+j}(\frac{a+1}{M})_{i+j}\cdots(\frac{a+M-1}{M})_{i+j}[(a_A)]_{i+j}[(b_B)]_i[(d_D)]_j \ x^i \ y^j \ (1-\zeta t)^{-(a+iM+jM)}}{[(e_E)]_{i+j}[(g_G)]_i[(h_H)]_j \ i! \ j!}$$

Suppose L.H.S. of (3.1) is denoted by Ω, then

$$\Omega = \sum_{i=0}^{\infty}\sum_{j=0}^{\infty}\sum_{n=0}^{\infty} \frac{(a)_{M(i+j)}[(a_A)]_{i+j}[(b_B)]_i[(d_D)]_j \ (a+iM+jM)_n \ x^i \ y^j \ \zeta^n \ t^n}{[(e_E)]_{i+j}[(g_G)]_i[(h_H)]_j \ M^{M(i+j)} \ i! \ j! \ n!}$$

$$= \sum_{i=0}^{\infty}\sum_{j=0}^{\infty}\sum_{n=0}^{\infty} \frac{(a)_{M(i+j)+n}[(a_A)]_{i+j}[(b_B)]_i[(d_D)]_j \ x^i \ y^j \ \zeta^n \ t^n}{[(e_E)]_{i+j}[(g_G)]_i[(h_H)]_j \ M^{M(i+j)} \ i! \ j!} \times$$

$$\times \sum_{p=0}^{n} \frac{(-1)^p \ (c+2p)(c)_p \ [(k_K)]_n}{(c)_{n+p+1}(n-p)! \ [(\ell_L)]_n \ p!} \ {}_{L+2}F_K\left[\begin{array}{ll} -p,\ c-p,\ (\ell_L) & ; \\ & t \\ (k_K) & ; \end{array}\right]$$

$$= \sum_{i=0}^{\infty}\sum_{j=0}^{\infty}\sum_{n=0}^{\infty}\sum_{p=0}^{\infty} \frac{(a)_{M(i+j)+n+p}[(a_A)]_{i+j}[(b_B)]_i[(d_D)]_j[(k_K)]_{n+p}\, x^i\, y^j\, \zeta^{n+p}(-1)^p\,(c+2p)\,(c)_p}{[(c_E)]_{i+j}[(g_G)]_i[(h_H)]_j[(\ell_L)]_{n+p}\, M^{M(i+j)}(c)_{n+2p+1}\, i!\, j!\, p!\, n!} \times$$

$$\times {}_{L+2}F_K\left[\begin{matrix} -p,\ c+p,\ (\ell_L) & ; \\ & \\ (k_K) & ; \end{matrix}\ \begin{matrix} \\ \\ t \\ \\ \end{matrix}\right]$$

$$= \sum_{p=0}^{\infty} \frac{(a)_p\,(-\zeta)^p[(k_K)]_p}{(c+p)_p\,[(\ell_L)]_p\,p!}\ {}_{L+2}F_K\left[\begin{matrix} -p,\ c+p,\ (\ell_L) & ; \\ & \\ (k_K) & ; \end{matrix}\ \begin{matrix} \\ \\ t \\ \\ \end{matrix}\right] \times$$

$$\times \sum_{i=0}^{\infty}\sum_{j=0}^{\infty}\sum_{n=0}^{\infty} \frac{(a+p)_{M(i+j)+n}[(a_A)]_{i+j}[(b_B)]_i[(d_D)]_j[(k_K)+p]_n\, x^i\, y^j\, \zeta^n}{[(c_E)]_{i+j}[(g_G)]_i[(h_H)]_j[(\ell_L)+p]_n\, M^{M(i+j)}(c+2p+1)_n\, i!\, j!\, n!}$$

$$= \sum_{p=0}^{\infty} \frac{(a)_p\,(-\zeta)^p[(k_K)]_p}{(c+p)_p\,[(\ell_L)]_p\,p!}\ {}_{L+2}F_K\left[\begin{matrix} -p,\ c+p,\ (\ell_L) & ; \\ & \\ (k_K) & ; \end{matrix}\ \begin{matrix} \\ \\ t \\ \\ \end{matrix}\right] \times$$

$$\times \sum_{i=0}^{\infty}\sum_{j=0}^{\infty}\sum_{q=0}^{M-1}\sum_{n=0}^{\infty} \frac{(a+p)_{M(i+j)+nM+q}[(a_A)]_{i+j}[(b_B)]_i[(d_D)]_j[(k_K)+p]_{nM+q}\, x^i\, y^j\, \zeta^{nM+q}}{[(c_E)]_{i+j}[(g_G)]_i[(h_H)]_j[(\ell_L)+p]_{nM+q}\, M^{M(i+j)}(c+2p+1)_{nM+q}\, i!\, j!\, (nM+q)!}$$

$$= \sum_{p=0}^{\infty}\sum_{q=0}^{M-1} \frac{(a)_p(a+p)_q[(k_K)]_p[(k_K)+p]_q\,(-\zeta)^p}{(c+p)_p[(\ell_L)]_p[(\ell_L)+p]_q(c+2p+1)_q\,p!q!}{}_{L+2}F_K\left[\begin{matrix} -p,\ c+p,\ (\ell_L) & ; \\ & \\ (k_K) & ; \end{matrix}\ \begin{matrix} \\ \\ t \\ \\ \end{matrix}\right] \times$$

$$\times \sum_{i=0}^{\infty}\sum_{j=0}^{\infty}\sum_{n=0}^{\infty} \frac{(a+p+q)_{M(i+j+n)}[(k_K)+p+q]_{nM}[(a_A)]_{i+j}[(b_B)]_i[(d_D)]_j\, x^i\, y^j\, \zeta^{nM+q}}{[(c_E)]_{i+j}[(g_G)]_i[(h_H)]_j[(\ell_L)+p+q]_{nM}M^{M(i+j)}(1-q)_{nM}\,(c+2p+1+q)_{nM}\, i!\, j!}$$

$$= \sum_{q=0}^{M-1}\sum_{p=0}^{\infty} \frac{(-1)^p\,\zeta^{p+q}\,(a)_{p+q}[(k_K)]_{p+q}}{[(\ell_L)]_{p+q}(c+p)_p\,(c+2p+1)_q\,p!\,q!}\ {}_{L+2}F_K\left[\begin{matrix} -p,\ c+p,\ (\ell_L) & ; \\ & \\ (k_K) & ; \end{matrix}\ \begin{matrix} \\ \\ t \\ \\ \end{matrix}\right] \times$$

$$\times \sum_{n=0}^{\infty}\sum_{i=0}^{\infty}\sum_{j=0}^{\infty} \frac{M^{M(i+j+n)}\prod_{r=0}^{M}\left\{\left(\frac{a+p+q+r-1}{M}\right)_{n+i+j}\right\} M^{nML}\prod_{r=0}^{M}\left\{\left(\frac{(k_K)+p+q+r-1}{M}\right)_n\right\}}{M^{nML}\prod_{r=1}^{M}\left\{\left[\frac{(\ell_L)+p+q+r-1}{M}\right]_n\right\}M^{nM}\prod_{r=1}^{M}\left\{\left(\frac{c+2p+1+q+r-1}{M}\right)_m\right\}} \times$$

$$\times \frac{[(a_A)]_{i+j}[(b_B)]_i[(d_D)]_j\,(1)_n\,\zeta^{nM}\,x^i\,y^j}{M^{nM}\prod_{r=1}^{M}\left\{\left(\frac{1+q+r-1}{M}\right)_n\right\}[(c_E)]_{i+j}[(g_G)]_i[(h_H)]_j\,M^{M(i+j)}\,n!\,i!\,j!}$$

Now for the summation indices $n,\ i,\ j$, expressing the above triple power series into its corresponding hypergeometric form using (1.2), we obtain the R.H.S. of (3.1).

$$\Omega = \sum_{p=0}^{\infty}\sum_{q=0}^{M-L} \frac{(a)_{2p+q}(k_K)_{p+q}(-1)^p\,\zeta^{p+q}}{(\ell_L)_{p+q}\,(c+p)_p(c+2p-1)_q\,p!\,q!}\; {}_{L+2}F_K\left[\begin{matrix} p,\ c+p,\ (\ell_L) & ; \\ & 1 \\ (k_K) & ; \end{matrix}\right] \times$$

$$\times F^{(3)}\left[\begin{matrix} \Delta(M:a+p+q):: & - & ; & (a_A) & ; & - & : \\ & & & & & & \\ - & :: & - & ; & (c_E) & ; & - & : \end{matrix}\right.$$

$$\left.\begin{matrix} \Delta(M:(k_K)+p+q] & ; & (b_B) & ; & (d_D); \\ \Delta(M:(\ell_L)+p+q],\ \Delta^*(M:q+1),\ \Delta(M:c+2p+q+1) & ; & (g_G) & ; & (h_H) & ; \end{matrix}\right. \frac{\zeta^M}{M^{M(L-K-1)}},\ x,\ y\Bigg]$$

Proceeding in the same way accordingly, we can achieve (3.2).

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Sequence Analysis of Glucosylceramidase (Gaucher Disease) Using MATLAB

Vineeta Verma*, Vaishali**, Sharmila*** and Rahul Singh****

Abstract

Gaucher disease(GD) is a metabolic disorder inherited from a person's parents. In Gaucher disease glucocerebroside (a sphingolipid, also known as glucosylceramide) accumulates in cells and certain organs. In this paper we find the nucleotide sequence of both, a Glucosylceramidase (Gaucher disease) patients and a homo sapiens (normal human) and convert nucleotide sequence into amino acid sequence then compare between amino acid sequence of normal and mutated gene with the help of MATLAB functions. We find that Mutation at nucleotide resulting in the substitution of amino acid identified the type of gaucher disease.

Keywords: Gaucher disease, Glucosylceramidase, glucosylceramide, Mutation.

INTRODUCTION

Gaucher disease is a lysosomal storage disease characterized by the malfunction of glucocerebrosidase resulting in the accumulation of glucosylceramide and other sphingolipids in certain cells[3]. Gaucher disease is an inherited metabolic disorder. It's passed down through families. People with Gaucher disease don't have enough of an enzyme called glucocerebrosidase (GCase). Enzymes like GCase are proteins that perform several tasks, including breaking down fats (sphingolipids) in the body.

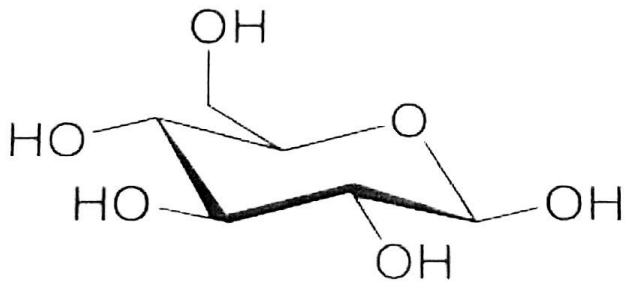

Fig1: Structure of Glucocerebroside

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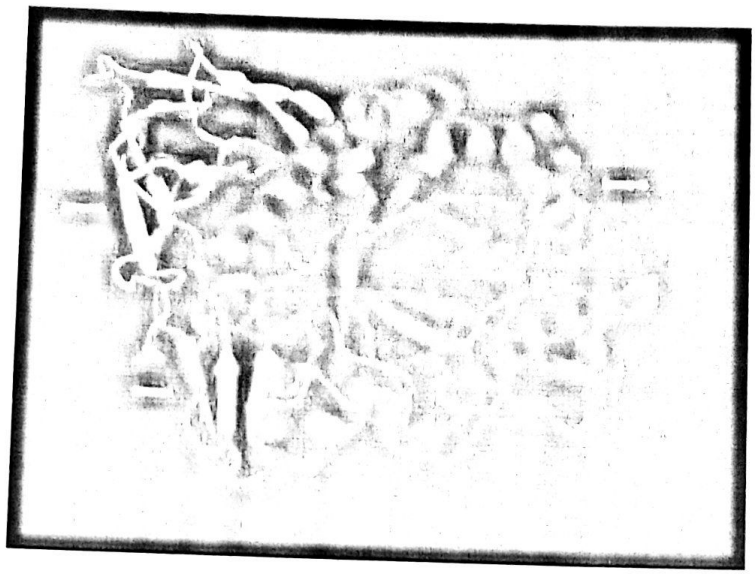

Figure 2: 3D Structure of Glucocerebrosidase

GLUCOCEREBROSIDASE

Glucocerebrosidase(also called acid -glucosidase, d-glucosyl-N-acylsphingocine glucosidase or GCase) is an enzyme with glucosylceramidase activity (EC NO 3.2.2.1.45)ie needed to cleave by hydrolysis, the-glucosidic linkage of the chemical glucocerebroside, an intermediate glycolipid metabolism. It is localised in the lysosome and has a molecular weight of 59700 Dalton[6].

The disease is named after the French physician Philippe Gaucher, who originally detected it in 1882. It is a form of sphingolipidosis (a subgroup of lysosomal storage diseases), as it involves dysfunctional metabolism of sphingolipids. More than 200 mutations in the GBA(Glucosidase beta acid) gene have been identified in people with Gaucher s disease. Most of GBA mutations responsible for Gaucher s disease, change a single amino acid in glucocerebrosidase. Without enough of this enzyme, glucocerebroside and other substances can build up to toxic level within the cell. Tissues and organs are damaged by abnormal accumulation and storage of these substances.

Gaucher disease is an inherited disease. Gaucher disease is inherited in families in an autosomal recessive pattern. Autosomal recessive inheritance means that a person has two copies of the gene that is altered. Usually, each parent of an individual who has Gaucher disease carries one copy of the altered gene(r). Since each parent also has a normal gene(R), they do not show signs or symptoms of Gaucher disease. Gaucher disease is caused by changes (mutations) in a single gene called *GBA*. Mutations in the *GBA* gene cause very low levels of glucocerebrosidase. A person who has Gaucher disease inherits a mutated copy of the *GBA*gene from each of his/her parents[9].

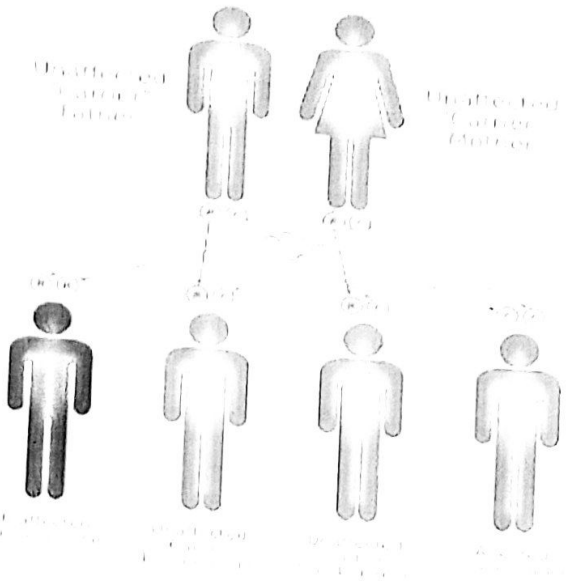

Fig. 3: Glucocerebrosidase is inherited in Autosomal recessive

An autosomal gene is located on a numbered chromosome and typically affects males and females in a similar manner. There are two copies of every autosomal gene and genetic carriers of an autosomal recessive disorder generally do not show any symptoms, because having one mutated gene is not enough to cause the disease. In those with two copies of the mutated gene, one copy is passed from the father and the other from the mother. For autosomal recessive disorders, if both parents are heterozygous genetic carriers of the disease, there is a 1 in 4 chance that the child will inherit both copies of the recessive mutated gene and develop the disease.

If the body doesn't have enough of these enzymes, fatty chemicals (called Gaucher cells) build up in the organs, bone marrow and brain. The excess fats cause a wide range of problems and symptoms. The disorder is characterised by bruising, fatigue anaemia, low blood platelets count and enlargement of liver and spleen, and is caused by a hereditary deficiency of the enzyme glucocerebrosidase (also known as glucosylceramidase may be), which acts on glucocerebrocide. When enzyme is defective, glucocerebrocide accumulates, particularly in white blood cells and specially in macrophages (mononuclear leukocytes). Glucocerebrocide can be collected in the spleen, liver, kidneys, lungs, brain and bone marrow. Manifestations may include enlarge spleen and liver, liver malfunction, skeletal disorder or bone lesion that may be painful, severe neurological complications, swelling of lymph nodes and (occasionally) adjacent joints, distended abdomen, a brownish tint to the skin, anaemia, low blood platelets count, and yellow fatty deposits on the white of the eye (sclera). Persons seriously affected may also be more susceptible to infection. Some forms of Gaucher's mutated treated with enzyme replacement therapy. The disease is caused by a recessive mutation in a gene located on chromosome 1 and affects both male and female. Gaucher's disease is the most common of the lysosomal storage disease.

Based on the type and severity of symptoms Gaucher disease is classified into neuronopathic (types II and III) and non-neuronopathic forms (type I), in which neurons and macrophages, respectively, are the primarily affected cell types

Gaucher disease type 1: The most common type in the U.S., Gaucher disease type 1 affects the spleen, liver, blood and bones. It does not affect the brain or spinal cord. Gaucher disease type 1 is treatable, but there is no cure.[8] For some people, symptoms are mild. Other people experience severe bruising, fatigue and pain, especially in the bones and belly. Symptoms can appear at any age, from childhood to adulthood.

Gaucher disease type 2: A rare form of the disorder, type 2 appears in babies under six months old. It causes an enlarged spleen, movement problems and severe brain damage. There is no treatment for Gaucher disease type 2. Babies with this condition pass away within two to three years[8]

Gaucher disease type 3: Worldwide, Gaucher disease type 3 is the most common form, but it's rare in the United States. It appears before age 10 and causes bone and organ abnormalities and neurological (brain) problems. Treatments can help many people with Gaucher disease type 3 live into their 20s or 30s[8]

TREATMENT

The diagnosis of Gaucher disease is based on clinical symptoms and laboratory testing. A diagnosis of Gaucher disease is suspected in individuals who have bone problems, enlarged liver and spleen (hepatosplenomegaly), changes in red blood cell levels, easy bleeding and bruising from low platlets or signs of nervous system problems[8]

Laboratory testing involves a blood test to measure the activity level of the enzyme glucocerebrosidase. Individuals who have Gaucher disease have very low levels of this enzyme activity. A second type of laboratory test involves DNA analysis of the GBA gene for the four most common GBA mutations. Both enzyme and DNA testing can be done prenatally. A bone marrow or liver biopsy is not necessary to establish the diagnosis[8]. When the specific gene mutation causing Gaucher disease is known in a family, DNA testing can be used to accurately identify carriers. However it is often not possible to predict the patient's clinical course based upon DNA testing.

Enzyme replacement therapy is now available as an effective treatment for individuals who have symptoms from Gaucher disease. The treatment involves giving a modified form of the enzyme, glucocerbrosidase, by intravenous infusion every two weeks. Enzyme replacement therapy helps to stop progression and often reverse many of the symptoms of Gaucher disease, but does not affect the nervous system involvement. Several other therapies including oral treatments are in various stages of development. Other treatments that have been required include: removal of the spleen (splenectomy), blood transfusions, pain medications, and joint replacement surgery.

EPIDEMIOLOGY

The prevalence of Gaucher disease ranges from 0.70 to 1.75 per 100,000 individuals. The standardized birth incidence of Gaucher disease within the general population varies from 0.39 to 5.80 per 100,000 individuals[10]. However, the prevalence of Gaucher disease Type 1 is higher in individuals with Ashkenazi Jewish ethnicity, with a birth incidence of approximately 1 in 850. Gaucher disease Type 1 is considered more prevalent in Western countries such as Europe, Israel, the US, and other European-derived Caucasian populations. Gaucher disease Types 2 and 3 primarily occur in non-Western countries, including non-Israeli Middle East, Indian subcontinent, China, Japan and Korea.

MATLAB

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typically uses in Math and computation, Algorithm development, Modeling, simulation, and prototyping, Data analysis, exploration, and visualization, Scientific and engineering graphics, Application development, include Graphical User Interface building. MATLAB is an interactive system whose basic data element is an array that does not require dimensioning, and it allows solving many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar non-interactive language.

MATLAB enables you to access datasets from a wide variety of sources, including databases, custom file formats, and web services; apply leading-edge analysis methods to your signal, image, video, molecular, and other datasets.

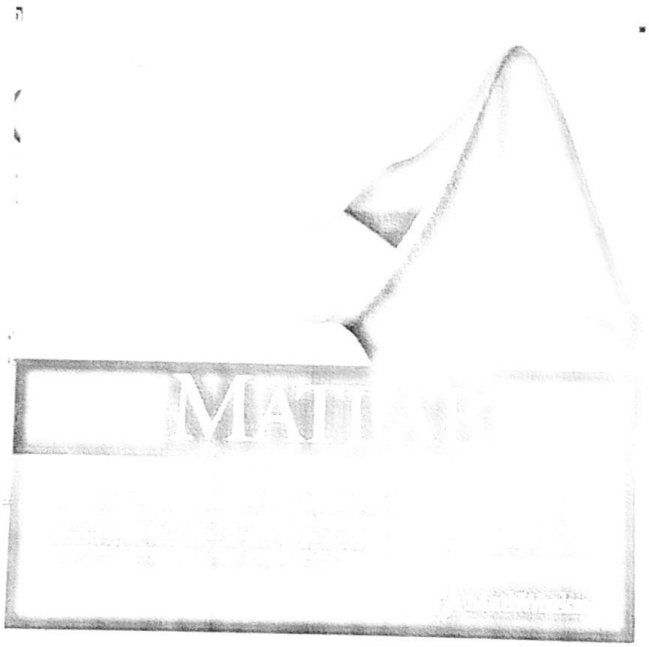

Fig 4: Logo of MATLAB

METHOD

Gaucher disease is a genetic disorder inherited from a person>s parents. To find the nucleotide sequence of a Gaucher disease patient through MATLAB, we open the ncbi web site with the help of web function i.e. web ('http://www.ncbi.nlm.nih.gov/'). To store the nucleotide sequence we declare a MutatedGBA variable, which can be access by the function getgenbank with accession number 'M24119'. After retrieve nucleotide sequence using SeqAA=nt2aa(seqNT) command convert nucleotide sequence into amino acid sequence of both a Gaucher disease patient. Similarly the nucleotide sequence of a normal human (homo sapiens) will be accessed and converted into amino

acid sequence by the accession number 'AH006907'. Plot a graph of sequence analysis of normal gene and mutated gene amino acid sequence by using seqdotplot=('Accession no.', 'Accession no.') function. All functions are available in API library in MATLAB.

RESULTS

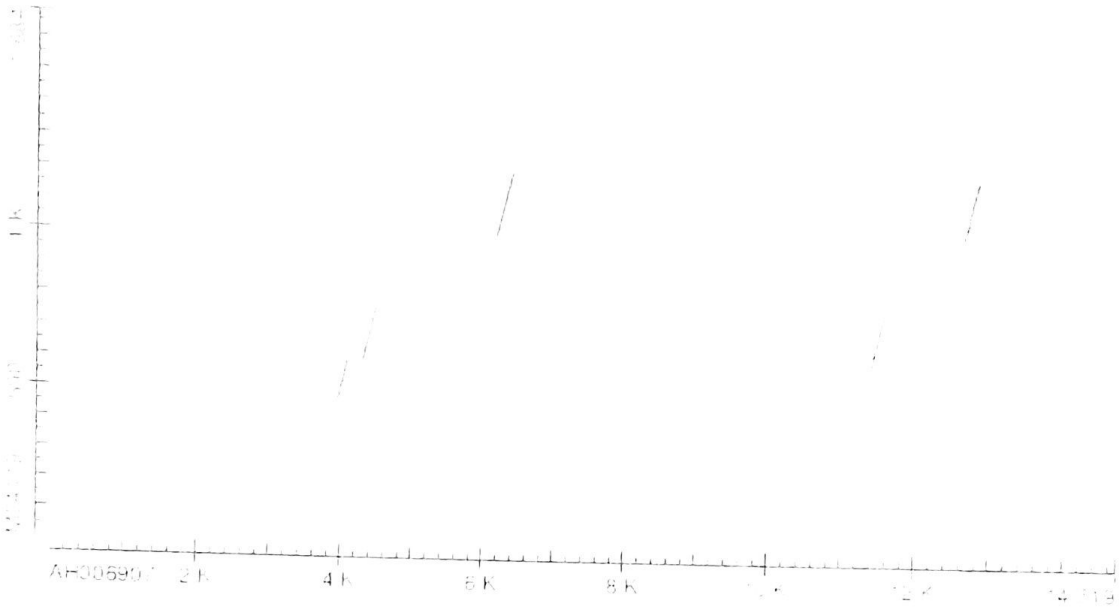

Fig 5 : Graph of Normal Homo Sapiens and Gaucher Desiese Patient

After finding the nucleotide sequence and converted it in to amino acid sequence Gaucher disease patient accession number M24119 and a normal human (homo sapiens) accession number 'AH006907' we plot a graph that shows Normal gene 'AH006907' at X-axis and Mutated gene 'M24119' we analyses Mutation at nucleotide 1226 resulting in the substitution of amino acid 370 Asparagines (N) for Serine(S) identified as N370S mutation. This mutation is associated with type 1 gaucher disease only. Mutation at nucleotide 1448 resulting in a leucine to proline change at amino acid 444, is associated with the neuronopathic forms of gaucher disease.

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35

Millets and Its Nutritional Benefits: International Year of Millets-2023

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Introduction

Millets are traditional grains, grown and consumed in the Indian subcontinent from the past more than 3000 years. Millets are small - grained, annual, warm - weather cereals belonging to grass family. They are rain - fed, hardy grains which have low requirements of water and fertility when compared to other popular cereals. They are highly tolerant to drought and other extreme weather conditions. Millets are nutri cereals comprising of sorgum, pearl millet, finger millet (Major millets) foxtail, little, kodo, proso and barnyard millet (minor millets). These are one of the oldest foods known to humanity. These are one of the several species of coarse cereal grasses in the family poaceae, cultivated for their small edible seeds. Pseudo millets are so called because they are not part of the Poaceae botanical family, to which 'true' grains belong, however, they are nutritionally similar and used in similar ways to 'true' grains. Millets are highly nutritious, non-glutinous and non acid forming foods. Millets have many nutraceutical and health promoting properties especially the high fibre content. Millets act as a prebiotic feeding for micro - flora in our inner ecosystem. Millets hydrate our colon to keep us from being constipated. Niacin in millet can help lower cholesterol. Millets contain major and minor nutrients in good amount along with dietary fibre. Millets are gluten free and can be a substitute for wheat or gluten containing grains for celiac patients.

Nutritional Composition of various types of Millets with their Local Name: Millets are high in nutrition and dietary fibre. They serve

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Economic analysis and crop equivalent of sugar cane (saccharum officinarum) based intercropping system in western plain zone of uttar Pradesh

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Abstract

An experiment was conducted during rabi 2015-16 at farmers field and crop cafeteria , K.V.K. , Moradabad under Sardar vallabhbhai Patel University of Agriculture & Tech. , Meerut (Uttar Pradesh) to study the economic analysis and crop equivalent yield of sugarcane (Saccharum officinarum) based intercropping system in western plain zone of Uttar Pradesh. The experiment was laid out in randomized block design with three treatments of cropping systems i.e. (sole Sugar cane, sole Mustard, sole Garlic , S.cane + Mustard , S. cane + Garlic), were replicated in the rice. Results revealed that maximum S.cane equivalent yield (748.50 q/ha.) was obtained in S.cane + garlic followed by S.cane + Mustard. The highest net income was obtained in S.cane + Garlic (Rs.3,18,258.00), Whereas lowest in sole crop of Mustard (Rs. 32,300.00). Among the second highest net return was obtained from the sole crop of Garlic (Rs.2,20175.00). The highest B:C ratio (benefit cost ratio) was found in S.cane + Garlic (1:1.65) followed by S.cane + Mustard (1:1.60). The lowest B:C ratio was observed in S.cane sole crop(1:1.0). The land equivalent ratio (LER) was highest in S.cane + Mustard and lowest in control plots.

Introduction -: India is the second largest producer of sugar after Brazil with a global share of 17% in 2014-15. Over five million farmers are involved in the cultivation of sugarcane in tropical and subtropical India and in agriculture sectore, sugarcane shared is about 7% of the total value of agricultureout put

Millets - Good for People, The Environment & Farmers: IYoM-2023

AMIT TOMAR AND R.P. SINGH

ICAR-Krishi Vigyan Kendra, Gajraula, Amroha, (Directorate of Extension), Sardar Vallabhbhai Patel University of Agriculture Science & Technology, Meerut

Introduction

Millets are resilient cereals that can provide an affordable and nutritious option and help guarantee food security. They are also deeply rooted in Indigenous Peoples' culture and traditions. The United Nations General Assembly at its 75th session in March 2021 declared 2023 the International Year of Millets (IYM 2023) with the Food and Agriculture Organization of the United Nations (FAO) as the lead agency.

Why are millets a smart food?

Millets encompass a diverse group of **cereals** including pearl millet, proso millet, foxtail millet, barnyard, kodo, browntop, finger

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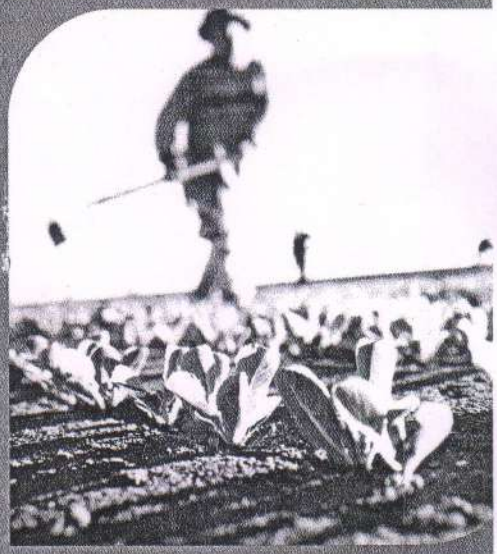

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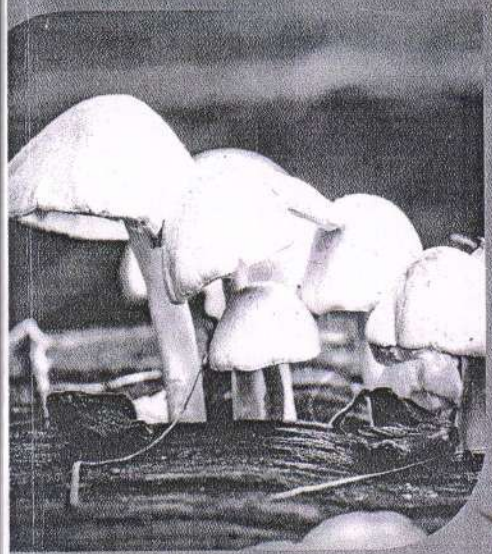

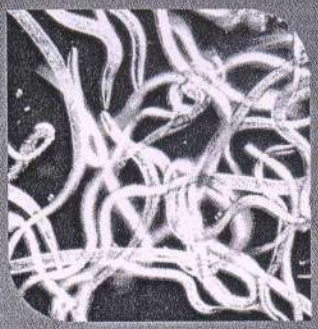

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temperature). Additionally, rainfall showed a strong positive correlation (r = 0.7936) with whitefly incidence and was statistically significant (p = 0.0036**). These findings provide valuable insights into the differential responses of aphids and whiteflies to weather factors, emphasizing the importance of considering environmental influences in pest management strategies. Continuous monitoring and adaptive approaches are essential for mitigating potential crop damage and ensuring the sustainability of potato cultivation practices amidst evolving environmental conditions.

Key words: Temporal Trends, Aphid Populations, Whitefly Dynamics, Weather Influences

Artificial Intelligence in Farming: A Smart Approach to Sustainable Agriculture

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Abstract

The integration of Artificial Intelligence (AI) in farming represents a paradigm shift in agricultural practices, heralding a new era of smart and sustainable agriculture. This paper explores the multifaceted applications of AI in farming, emphasizing its pivotal role in optimizing resource utilization, enhancing crop yields, and promoting eco-friendly practices. AI-driven technologies, such as machine learning, data analytics, and computer vision, empower farmers with real-time insights into crop health, soil conditions, and weather patterns. This smart approach enables precise decision-making, from planting to harvesting, resulting in increased efficiency and reduced environmental impact. The abstract delves into specific AI applications, including predictive modelling for disease detection, autonomous machinery for precision farming, and intelligent irrigation systems. It highlights how AI algorithms process vast datasets to forecast pest infestations, enabling proactive measures that minimize reliance on chemical inputs. The use of robotics and drones equipped with AI enhances crop monitoring, contributing to sustainable practices by minimizing resource wastage. Furthermore, it's important to discuss the economic implications of AI in farming, emphasizing its role in promoting financial sustainability for farmers. AI algorithms process vast datasets to predict weather patterns, enabling farmers to make informed decisions about planting and harvesting. In disease detection, AI-powered systems analyze images of crops to identify early signs of diseases, facilitating timely intervention. The adoption of AI-driven technologies not only improves productivity but also facilitates market access and better price realization. As the agricultural sector faces unprecedented challenges, AI emerges as a transformative force that aligns productivity goals with environmental stewardship, paving the way for a smarter and more sustainable future in agriculture.

Keywords- AI, Smart agriculture, eco-friendly, crop health, weather, precision farming, drones

Bridging The Gap Between Tradition and Innovative Agriculture Through New Age Digital Technologies

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Abstract

Agriculture today faces growing pressure from numerous factors, including population growth, climate change, and resource depletion. Traditional agricultural practices have been used since ancient times but are inadequate to ensure long-term environmental and economic sustainability. In agriculture today, the use of cutting-edge technologies like robotics and artificial intelligence (AI) is increasing, helping achieve sustainable agricultural goals. These practices are paving the way for a future where abundance and environmental responsibility can coexist. Researchers have highlighted the profound impacts of these technologies on the different aspects of sustainability. Precision agriculture, empowered by data-driven insights from sensors and satellite imagery, is leading the charge. Real-time monitoring of soil health, crop stress, and weather patterns allows for the targeted application of water, fertilizers, and pesticides, minimizing waste and environmental impact. Scientists have demonstrated the use of AI-powered irrigation systems to significantly reduce water usage while maintaining yields. Robotics is also crucial in reducing labour dependence and promoting

sustainable practices. Autonomous tractors and drones are now employed for seeding, weeding, and harvesting, minimizing soil compaction and reliance on fossil fuels. Successful deployment of autonomous weeding robots has led to a significant reduction in herbicide use. AI's analytical prowess is also aiding in breeding climate-resilient crops and predicting pest outbreaks. By analysing vast datasets of genetic information and environmental factors, researchers can develop crops better adapted to changing weather patterns and resistant to diseases. AI has been recently utilized to identify genes controlling heat tolerance in wheat, paving the way for more resilient varieties. However, embracing these technologies comes with challenges. Addressing the digital divide in rural areas, ensuring data security and privacy, and building trust among farmers are crucial aspects that require thoughtful solutions. Additionally, ethical considerations surrounding automation and potential job displacement necessitate careful planning and workforce training programs. In conclusion, integrating new-age digital technologies presents a golden opportunity to address the sustainability challenges in agriculture. From precision resource management to climate-resilient crops, these advancements hold immense potential to create a future where agricultural productivity thrives alongside environmental health. By addressing the existing challenges and fostering inclusive innovation, we can cultivate a greener future for future generations.

Keywords*:* Agriculture, Climate change, Digital technologies, Sustainability, Robotics

Digital Agriculture Technologies: Insights from a Developing Nation

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Abstract

Digital agriculture technologies (DATs) provide great promise to transform farming methods in underdeveloped countries by tackling major issues such resource scarcity, climatic variability, and food insecurity. A large percentage of the workforce is employed in agriculture, which is the main driver of the economies of many developing countries. It also contributes to food security and rural livelihoods. But the needs of an expanding population and a shifting environment are frequently beyond the reach of conventional farming practices. DATs provide smallholder farmers with creative ways to increase output, maximize resource utilization, and expand their market access. Blockchain-enabled supply chain management systems, mobile applications, remote sensing, and precision agriculture technology are some of the key DATs.With the use of these technology, farmers can more effectively connect with markets, monitor crop health, and manage irrigation and weather forecasting. DATs enable farmers to make educated decisions and adjust to changing conditions by digitizing agricultural operations and providing them with real-time information and decision support tools. However, there are a number of obstacles to the adoption of DATs in developing countries, such as inadequate digital literacy, inadequate infrastructure, and financial limitations. Through investments in digital infrastructure, the provision of training and capacity building programs, and the promotion of inclusive and sustainable business models, governments, non-governmental organizations, and stakeholders in the private sector all play critical roles in removing these obstacles. Notwithstanding these difficulties, DATs have a number of positive effects on poor countries, from better food security and resilience to the effects of climate change to higher farmer yields and incomes. Developing countries may unleash the potential of their agricultural sector to propel economic growth, mitigate poverty, and accomplish sustainable development objectives by utilizing digital agriculture technologies.

Keywords: Digital Agriculture Technology, Climate Variability, Food Security and Sustainable