

Udai Pratap Autonomous College, Varanasi



3.4.3 Proof of Paper Publications in Journals

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Research Article

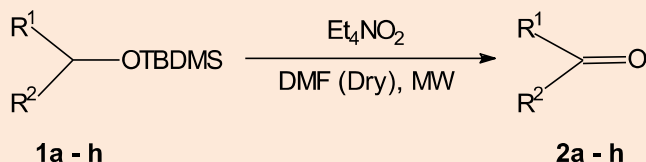
One-Pot Oxidative Deprotection of Aliphatic *tert*-Butyldimethylsilyl Ethers using Tetraethylammonium Superoxide under Microwave IrradiationSurabhi Pandey¹, Balmukund Yadav¹, Ajay K. Shukla² and Raghvendra S. Raghuvanshi^{1*}¹Department of Chemistry, Faculty of Science, Uday Pratap (Autonomous) College, Varanasi 221002, India²Department of Chemistry, T.D.P.G. College, Jaunpur 222002, India**Abstract**

Oxidative deprotection of *tert*-butyldimethylsilyl ethers to their corresponding carbonyl compounds has been achieved using *in situ* generated tetraethylammonium superoxide under microwave irradiation.

Keywords: Deprotection, superoxide, TBDMS, microwave irradiation

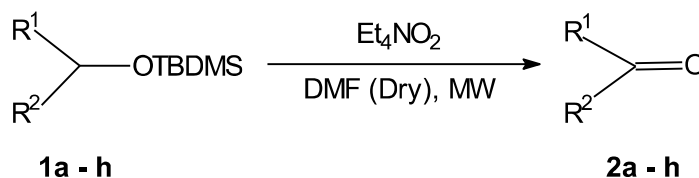
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**Introduction**

The protection of hydroxyl functions as *tert*-butyldimethylsilyl (TBDMS) ethers has been recognized as one of the most useful protecting methods in organic synthesis because of the ease in which it can be introduced to and removed from alcohols [1, 2]. Though a large number of reagents have been used to remove the TBDMS group [2], however, there are very few procedures for one step removal and oxidation [3-13]. Often these procedures utilize hazardous reagents, high acidic medium and prolonged reaction times.

In the view of the above and as a part of our ongoing research program on superoxide chemistry [14, 15], we describe herein our results on the reactivity of *in situ* generated tetraethylammonium superoxide (Et₄NO₂) with different *tert*-butyldimethylsilyl ethers in dry DMF under microwave irradiation, affording corresponding carbonyl compounds (Scheme 1).



Scheme 1. Preparation of carbonyl compounds.

Experimental Procedure

Potassium superoxide and tetraethylammonium bromide were procured from E. Merck, Germany and were used as received. Dry DMF of Aldrich, USA was stored over molecular sieves (4Å) prior to use. The substrate *tert*-butyldimethylsilyl ethers were prepared according to a literature procedure [16]. A Kenstar digital microwave oven at full power (800 W) was used.

General procedure for the oxidative deprotection of *tert*-butyldimethylsilyl ethers

A mixture of potassium superoxide (0.43g; 0.006 mol) and tetraethylammonium bromide (0.63g; 0.003 mol) were weighed under nitrogen atmosphere using an atmosbag and were transferred into the two-necked round bottom flask equipped with a magnetic stirrer, nitrogen inlet and a Liebig condenser protected by calcium chloride drying tube. Dry dimethylformamide (15 ml) was added to it and the mixture was agitated magnetically for 15 min to facilitate the formation of tetraethylammonium superoxide. The substrate *tert*-butyldimethylsilyl ethers **1a-h** (0.003 mol) was finally introduced and the contents of vessel were subjected to microwave irradiation for the specified time (Table 1).

Synthesis of Some Novel fused pyrazolo[4,5-e]pyrimidine derivatives bearing oxa/thiadiazole Nucleus as Potential Antimicrobial Agent

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Abstract

A series of some novel fused 1-(substituted phenoxyethyl)-7-(4-tolylloxymethyl)-4-oxypyrazolo [4,5-e][1,3,4]oxadiazolo[2,3-b]pyrimidine (**2**) & 1-(2-chlorophenoxyethyl)-7-(4-tolylloxymethyl)-4-oxypyrazolo-[4,5-e][1,3,4]thiadiazolo[2,3-b]pyrimidine (**3**) derivatives have been synthesized from Michael adduct 1-(2-methylphenoxyethyl)-5-amino-4-carboethoxy-pyrazoles (**1**) respectively which in turn have been prepared via intermolecular Michael addition, followed by cyclisation reaction between tolyloxyacetohydrazine and ethyl-2-cyano-3-ethoxyacrylate in methanol and glacial acetic acid as catalyst. The Michael adduct (**1**) afforded fused system (**2**) & (**3**) via nucleophilic addition followed by cyclisation with 2-(4-tolylloxymethyl)-5-mercapto-1,3,4-oxadiazole and 3-(4-chlorophenyl)-5-mercapto-1,3,4-thiadiazole, respectively. The structures of these compounds have been established on the basis of spectral data IR, ¹H NMR, ¹³C NMR and elemental analysis. All the synthesized compounds have been screened for antibacterial activity against *Escherichia coli*, *Pseudomonas aeruginosa*, *Streptococcus pneumoniae* and *Bacillus subtilis* and antifungal activity against fungi viz. *Candida albicans*, *Aspergillus fumigatus*, *Aspergillus niger* and *Aspergillus flavus*. The results showed that these compounds are better antibacterial and antifungal agent as compared to the standard drug ciprofloxacin and fluconazole respectively.

Keywords: pyrazolopyrimidine, 1,3,4-oxadiazole, thiadiazole, Antifungal, Antibacterial activity

Introduction

In the hierarchy of man's need, the provision of food & control of disease come at the top of priority. Food is the ultimate outcome of agricultural crops. To have nutritional and pure forms of food, the crops must be free from various diseases. The first objective of biocides research must therefore be to control the harms, caused by micro-organisms, pests and weeds, which destroy our crops, stored grains, fruits, vegetables, fabrics, leather, plastic etc. But the problems have not been solved completely. It is because the number and kind of pests and microorganisms are numerous and mode of living of one set differs widely from others. Hence it is impossible to control almost every pests and microorganisms with a limited number of compounds in hand. Therefore, it is necessary to have a large number of compounds so that selection of compounds of versatile activities can be made. Thus the basis of selecting heterocycles as the subject of this investigation was realization of the fact that heterocyclic compounds are in clinical use since a long time derived from natural source such as vitamins, hormones, and antibiotics [1-2]. From the above observation we selecting the fused heterocyclic nucleus is prazolo[4,5-e]pyrimidine. Prazolo[4,5-e]pyrimidine is one of the most important class of fused heterocyclic nucleuses which possess a wide variety of biocidal activities. Pyrazolo [4,5-e]pyrimidine are reported to

Insecticidal Activity, Toxicity, Resistance and Metabolism of Pyrethroids: a Review

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Abstract

Pyrethroids are synthetic or man-made versions of natural pyrethrins discovered in the flowers of a plant species of the Compositae family called "*Chrysanthemum cinerariaefolium*". The plant was transported into Europe and America after it was discovered in the Near East. Commercial insecticides such as pyrethrin and synthetic pyrethroid are available. These are used to control agricultural pests as well as non-agricultural insects. They are also commercially used in personal care items such as shampoo and as a scent in insect repellent to boost efficacy and persistence in the environment, these insecticides are frequently combined with additional chemicals in diverse formulations, known as synergists. Nerve toxins, known as pyrethroids, although their chemical mechanism of action is unknown. Pyrethroids are neurotoxins, which interfere with the messages sent along nerves by maintaining sodium and chloride channels in an open position. This review presents perspectives, commercial uses and other useful characteristics features of pyrethroids based on human benefits and environmental friendly.

Keywords

Pyrethroids, Pyrethrins, Neurotoxicity and Environmental Friendly

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1. INTRODUCTION

Pyrethroids are synthetic or man-made versions of natural pyrethrins discovered in the flowers of a plant species of the Compositae family called "*Chrysanthemum cinerariaefolium*" (often referred to as pyrethrum). The plant, which is native to the Near East, was first imported to Europe and America in the nineteenth century, then to Japan and Africa afterwards. Kenya and other African countries, Ecuador, and Japan are its key cultural regions. Pyrethrin's insecticidal capabilities come from the ketoalcoholic ester of chrysanthemic acid and the pyrethronic acids. These acids are very lipophilic, allowing them to easily permeate and paralyze the neural systems of many insects.

Natural chemicals contained in *Chrysanthemum cinerariaefolium* (Figure 1) extracts decompose rapidly when exposed to light, thus they've been replaced with synthetic derivatives that

were once thought to be safe for humans and higher animals (Bradberry et al., 2005; Costa, 2015; Soderlund, 2012). Since the 1980s, they've been used as insecticides all over the world due to their high efficacy and low toxic effects when contrasted towards other insecticides like organophosphates and carbamic ester chemicals (Cárcamo et al., 2017). Pyrethrum was discovered to have valuable insecticidal characteristics in the 19th century. In the first part of the twentieth century, these properties motivated a detailed research of the chemical composition of active esters. Commercial insecticides such as pyrethrin and synthetic pyrethroid are available. These are used to control agricultural pests as well as non-agricultural insects. To boost efficacy and persistence in the environment, these insecticides are frequently combined with additional chemicals in diverse formulations, known as synergists.

Pyrethroids are also used in personal care items including shampoo and insect repellent scent. In recent years, the pesti-

Bioremoval of Carpet Dye from Effluent and Their Influence on the Growth of Tomato (Gaytri F1) and *Cicer arietinum*

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The textile industry is one of the largest consumers of potable water and consequently, produces a huge amount of dye-containing wastewater. Discharge of this dye-bearing wastewater into the rivers poses severe problems to the aquatic life, food web and causes damage to the aesthetic nature of the environment. Colour removal from this wastewater is necessary not only because of its potential toxicity, but also mainly due to its visibility problem. There have been various techniques for the removal of dyes, like physical, chemical and biological, but the effectiveness of bioremoval of dye from wastewater has made it an ideal alternative to other treatment methods. The objective of this paper is to study the potential of removal of dye from textile water by fungi *Aspergillus niger* MTC1344 and its subsequent impact on the growth of the tomato and gram. *Aspergillus niger* is shown to be an efficient fungus for removal of Carpet dye effluent and it can decolorize dye effluent upto 78.40 ± 0.305 on 7th day of the incubation period. Germination, seedling growth and shoot length showed a significant increase at 10% and 25% of the effluent concentration.

KEYWORDS

Textile water, Wastewater, Removal, *Aspergillus niger* MTC1344, Bioremoval, Germination

1. INTRODUCTION

India is the second-largest manufacturer and exporter of textiles all over the world after China. The textile industry in India is the biggest employer after agriculture and provides 4.5 crore people and another 6 crores in allied sectors. Although one of the problems associated with the textile industry is the intolerable effluents, especially dyes, which are difficult to degrade. Textile industry uses a large quantity of potable water for fibre manufacturing and consequently releases huge amounts of wastewater [1]. For manufacturing 1 kg of textile material approximately 200 L of waters is used. This amount of water is required when chemicals are applied to the fabrics and during the rinsing process of the final products [2]. Dyes are usually highly visible and resist degrading. The classification of textile industries depends to the type of fabrics they produce, including cellulosic materials obtained from plants (for example cotton, rayon and linen), protein fabrics, which come from animals (for example wool, silk and mohair) and synthetic fabrics produced artificially (for example nylon, polyester and acrylic). Synthetic dyes are classified into different groups according to their chemical structure (for example azo, anthraquinone, sulphur, ph-

thalocyanine and triarylmethane) and according to their mode of application (for example reactive, direct, disperse, basic and vat dyeing) [3]. The dye effluents are high in colour, pH, suspended solids (SS), chemical oxygen demand (COD), biochemical oxygen demand (BOD), metals, temperature and salts [4-8]. Disposal of this dye effluent into receiving water can be toxic to aquatic life and cause food chain contamination, resulting in deleterious health effects even in very low concentrations. Moreover, most of these dyes can cause allergy, dermatitis, skin irritation and also provoke cancer and mutation in humans [9]. Dyes are usually highly visible, very difficult to biodegrade and extremely difficult to eliminate in natural aquatic environments [10].

A lot of methods were applied for the removal and degradation of dyes, like physical, chemical and biological. Out of these methods, physical and chemical treatments, such as coagulation-flocculation, filtration, adsorption, ozonation, ion exchange and Fenton's method are most widely used in industry. However, these treatment methods have several drawbacks, such as high cost, generation of sludge and other secondary pollutants and hence there is a need for sophisticated technologies. In contrast, biodegradation is a cheap, eco-friendly and innovative approach that could clean the water system by eliminating dyes through the processes, such as biosorption and biodegradation [11,12]. The ability of microbial degradation in xenobiotic

Seasonal Variation in Hematological and Histomorphological Parameters in the Garden Lizard, *Calotes versicolor*

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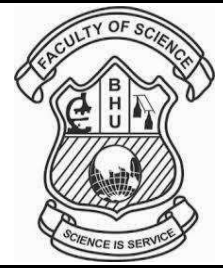
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Seasonal variations in the physiological processes help animal to adapt to the environmental condition, however, informations on this subject in reptiles are scarce. In the present study, garden lizards (*Calotes versicolor*) were used to study the annual variation in blood immune responses and changes in the lymphoid organs. The lizards were weighed, anaesthetized under mild anesthesia and blood was collected in heparinized syringe. Blood was then processed for determining total leucocyte count, differential leucocyte count and nitroblue tetrazolium reduction test (Slide assay) for assessment of reactive oxygen production by leucocytes. For histomorphological studies, spleen, thymus and testes were excised rapidly, cleaned and weighed and their weight was transformed to thymosomatic, splenosomatic and gonadosomatic indices respectively. Total leucocyte count did not change significantly, however, differential leucocyte count varied during different seasons. Thymosomatic index was lesser in summer and rainy months. Splenosomatic index started increasing from May and remained high up to August (the hot and humid months of the year and reproductively active months). Gonadosomatic index was low from September to March. It started increasing from April and remained at highest level from May to August. Environmental factors play an important role in body physiology, oxidation, and intermediary metabolism and gonadal activity of all the vertebrates, including reptiles. The annual variation in physiology is pivotal to help animals cope with seasonal stressors.

Key words: Seasonal variation, Reptiles, leucocytes, Annual rhythm, lymphoid organs



Effects of Pesticides on Haematological Parameters of Fish: Recent Updates

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Abstract: Since the blood takes part directly or indirectly in various physiological processes of the body, haematological parameters are considered important biomarker of alterations in metabolism or physiology. Indiscriminate use of pesticides has polluted different water bodies with adverse effects on the health of aquatic biota including fishes. Toxicological effects of agrochemicals including pesticides can be observed by monitoring haematological parameters. Present review deals with study of effects of pesticides on the important blood parameters such as erythrocyte count, haemoglobin content, packed cell volume, erythrocyte sedimentation rate, absolute values, leucocyte count, coagulation time and thrombocyte count of freshwater fish species. The review also aims to explain possible mechanism of pesticide induced alterations in the parameters and deleterious consequences on fish health. This could help to explore the future prospects of research in the concerned field. Haematological parameters of fish could thus serve as sensitive index to examine health status and to ascertain the toxic effects on ecosystem under pesticide exposure in the era of increased pesticide utilisation.

Index Terms: Fish, Pollution, Pesticides, Haematological parameters, Toxic effects

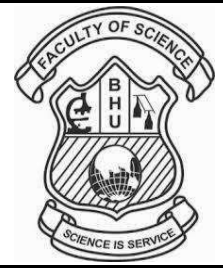
I. INTRODUCTION

Now-a-days, detrimental ecological consequences posed by indiscriminate use of pesticides in agriculture are of great concern in general. Moreover, the increasing trend of Indian population requires self-sufficiency in food production by improved tools and techniques and effective chemicals. Pesticides are one of those agrochemicals that are widely used in agriculture to control different types of pests e.g. insects, unwanted weeds, parasitic nematodes and fungus (Tudi et al., 2021). They are being extensively used not only in the developed countries but also in developing countries to increase food production and its quality. Thus the pesticides have

occupied significant and inseparable association with the advance agricultural achievements in our country. In pesticide production and consumption, India is the biggest country in Asia and twelfth in the world while at fourth position for export (Devi et al., 2017).

In past few decades, a considerable number of researches have been carried out in relation to the adverse effects of toxic pesticides on environment and biodiversity. These chemicals are particularly the persistent ones and bring about disturbances in ecological balance in nature and various kinds of health hazards by leaving residues. A very small portion of total pesticides is in fact effective in killing or controlling target pest, while remaining large amount is released in the environment including aquatic ecosystem to have negative impact on non-target species (Tudi et al., 2021; Özkara et al., 2016). There are overwhelming evidences depicting the adverse effects of pesticides on aquatic ecosystem (Barlas 1999; Aktar et al., 2009). They pollute water by discharging surplus formulation after spraying operations into rivers, ponds and lakes, pouring the washing water of spraying equipments into water bodies; extending spread crops to the water's edge, accidental spillage of agrochemical formulations, run-off and erosion from treated areas, fallout from air pollution by agrochemical industrial effluents etc.

Water pollution is the cause of death of several interdependent aquatic forms of life and also a source of bio-magnification of persistent pesticides. This can result in local effect on environment and mortality of fish. Fishes are particularly sensitive to any change in physicochemical as well as biological characteristics of aquatic bodies. The toxic chemicals in aquatic environment are proved to be dangerous for the survival of fish (Caldas et al. 1999; Lamai et al. 1999; Sayeed et al. 2000; Isenring, 2010; Zacharia, 2011). Therefore, fish are regarded as very sensitive biological indicators of any adverse change in the



Effects of Pesticides on Haematological Parameters of Fish: Recent Updates

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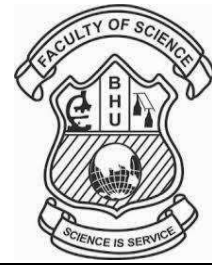
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Antileishmanial potential of different extracts of *Curcuma longa* rhizome against *Leishmania donovani*

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Abstract: Plants are an excellent source of herbal medicines and their natural products have antimicrobial potential for the management of numerous diseases. This study investigated the antileishmanial activity (IC₅₀ - 50% inhibitory activity) of *Curcuma longa* (rhizome) crude extracts (80% methanol, chloroform, and acetone) against (*Leishmania donovani*) promastigote and amastigote forms. All three extracts of *C. longa* exhibited antileishmanial activity on both forms of parasite *Leishmania*. Miltefosine was used as a reference drug in this study. The methanolic extract showed the maximum antileishmanial activity followed by chloroform and acetone extract against both the forms promastigotes and amastigotes. The cytotoxicity (CC₅₀) of these extracts were evaluated by 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay which was ranging from 889.89 to 969.01 µg/ml. The safety parameter was determined in terms of selectivity index (SI) which was found to be highest for methanolic extract (46.71) followed by chloroform (26.38), reference drug miltefosine (11.65) and acetone extract (4.41). Further, GC-MS analysis of 80% methanolic extract was carried out and identified 51 compounds, out of which were secondary metabolite (2,3-dihydrobenzofuran) sesquiterpenes, terpenoids, monoterpene and phenolic acids was most prominent that could be responsible for its antileishmanial activity. The results revealed that all three extracts have potent antileishmanial activity and it could be used in the formulation of herbal medicine against *L. donovani* in future prospect.

Index Terms: Cytotoxicity, Leishmaniasis, Miltefosine, Natural compounds, Promastigote.

I. INTRODUCTION

Plant products are the magical weapon on earth and are being used by human beings from very ancient times for the treatment of several diseases with lesser side effects. The plant natural products excellently work against many microbes. (Cowan, 1999). The secondary metabolic products/compounds such as phenol, terpenoid, alkaloid etc. of plants have an excellent antimicrobial, antifungal, and antiparasitic potential along with avast source of pharma products (Srinivasan *et al.*, 2001). The family Zingiberaceae consists of above 80 species of rhizomatous herbal plants and the genus *Curcuma* is one of the herbs under this family (Sasikumar, 2005). *Curcuma longa* is a widely studied rhizomatous flowering plant having great potential for effective treatment of a wide range of diseases (Sanjay *et al.*, 2007). Leishmaniasis is a tropical disease caused by *Leishmania*, a protozoan parasite that lives in mammals as an intracellular parasite and it multiplies in macrophages.(Alvar *et al.*, 2012). The Life cycle of the parasite is digenetic and is transmitted through the bites of an insect female sandflies into the mammalian host (Gour *et al.*, 2012). About 350 million people are affected by this disease worldwide and approximately twelve million people alone in the America, Africa, Asia and Europe are directly suffering from this disease. (Burza *et al.*, 2018; Hoyos *et al.*, 2016). Out of top-ten tropical neglected diseases, leishmaniasis comes first which causes a high burden among people residing in developing nations. (Reithinger *et al.*, 2007). The clinical symptoms of leishmaniasis represents itself in three forms the mucocutaneous leishmaniasis (MCL), cutaneous leishmaniasis (CL) and the visceral leishmaniasis (VL) (Gour *et*



Semi-Analytic Solutions of Electrohydrodynamic Flow in a Circular Cylinder Conduit

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ABSTRACT

This paper is intended to construct a new modification of the optimal homotopy asymptotic method that can be used to solve various nonlinear boundary value problem (BVP). This modification is called the modified optimal homotopy asymptotic method (MOHAM). The modification is based on the unique way of representation of nonlinear terms in different powers of embedding parameter q . We have tested the proposed method-MOHAM to the nonlinear BVP that reveals the electrohydrodynamic (EHD) flow of a fluid in an ion drag configuration in a circular cylindrical conduit. This is a singular second-order ordinary differential equation. We have also given the solution of the EHD flow equation using optimal homotopy asymptotic method (OHAM) by taking the linear operator $L(=L_2) = \frac{d^2}{dr^2} + \frac{1}{r} \frac{d}{dr}$ different from the previous study. Also, we have made the comparison of solution obtained by our proposed method and the existing results.

Keywords: Electrohydrodynamic flow; Modified optimal homotopy asymptotic method; Nonlinear boundary value problem; Optimal homotopy asymptotic method; Square residual error



Production and Marketing of Cucumber Crop in Chiraigaon Block of Varanasi, Uttar Pradesh

Rakesh Kumar¹ and Chandra Sen*²

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Key words: Cost of cultivation, Gross income, Net income, Marketing channels

India stands the second largest producer of vegetables in the world just after China. It contributes over 14.6 per cent of the world's vegetable production with an annual production of 185 million metric tones within an area of 16.2 mha. Out of this lady's finger 5.13 m ha, cucumber 1.09 m ha, and bitter gourd 0.99 m ha with production the 6.17 MT, 1.696 MT and 1.198 MT respectively [1]. West Bengal takes first rank in India with regards to area 29.545 lakh ha, production 14.9 lakh MT followed by Uttar Pradesh with an area and production 1256.27 thousand ha and 27703.83 thousand metric tonnes respectively [1]. Vegetable production is a high cost and labor intensive which need a careful management of resources before allocating the area under these crops. The farmers who are interested to go for these enterprises should be well aware with different type of information about the enterprise like the total cost of particular vegetables, the operational cost, the gross and net returns they will get from this enterprise [2]. If farmers have such valuable information, then they can allocate a manageable area under these crops and achieve a desirable benefit from this enterprise [3]. In this sense, this study will help to farmers to made available all this information through which they will improve their socio-economic condition and policy making. Marketing is also equally important as production for any agricultural product [4]. Due to high perish ability and seasonality, efficiency of marketing operation is crucial in determining the profit of the producer on the one hand and level of satisfaction of a consumer on the other. It is essential to be very careful about the market of vegetable produce in which the negligence may cause not only wastage of resources but also dissatisfaction to the producer and consumer. In general, marketing cost of vegetables is higher than food grains. This

point should also be taken care of by the financial institutions while advancing loan to the vegetable's growers. In Varanasi District total area and production of cucumber is 1220 ha and 61000 mt respectively. Where as in Chiraigaon block the total area under cucumber is 137 ha. The total production of cucumber in Chiraigaon block is 6550 mt. (Source: Department of Horticulture, Varanasi). Several studies on economic analysis of production and marketing of vegetables have been undertaken in the past [5-6]. The present study has been undertaken to analyze the economics of production and marketing of Cucumber in Chiraigaon block of district Varanasi, Uttar Pradesh.

The present study has been conducted if the Chiraigaon block of district Varanasi. Out of 141 villages in the block, only two villages have been selected randomly for the present study. There were 300 farmers in the sample villages and 30 farmers including 20 marginal and 10 small farmers have been selected for the study. The information about the production and marketing of cucumber has been collected the sample farmers for the year 2019-20.

Cost of cultivation and return from cucumber

The cost of cultivation of cucumber has been given in (Table 1). It reveals that per ha. cost of cultivation of cucumber crop on sample farm was Rs. 109247 on marginal farms to 113283 on small farms. The cost B accounting major share as 59.72 percent on marginal farms and 68.22 percent on small farms. Among the variable input cost manure and fertilizer accounting highest proportion i.e., 14.93 percent on marginal farms and 16.33 on small farms. There was no any definite trend in the cost of variable inputs with the size of farms except hired human labor than increase with the increase in size of farms [7].

It reveals from (Table 2) that per hectare cost of cultivation for cucumber ranging between Rs. 109247 on marginal farms to Rs. 113283 on small farms, whereas per hectare production varied between 400 qt on marginal farms to 440 qt. on small farms. Average gross income, farm business income, family labor income and net income were estimated Rs. 400000 Rs. 348878, 334753 and Rs. 290753 respectively on marginal farms and Rs. 440000, Rs. 376841.60, 362717 and Rs. 326717 respectively on small farms [8]. Output input ratio was ranging between 3.88 on small farms to 3.66 oil marginal farms.

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An Economic Analysis of Wheat Production in Uttar Pradesh, India

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ABSTRACT

Wheat is the major cereal crop of Uttar Pradesh grown in both irrigated and unirrigated conditions. The present study estimated various costs and returns in wheat cultivation under irrigated and unirrigated condition. Appropriate policy implication has been drawn for improving the farm economy of Uttar Pradesh.

KEYWORDS: Economics Analysis, Wheat Crop, Cost of cultivation, Irrigated and Unirrigated condition.

1. INTRODUCTION

India has been second largest producer of wheat after china. It covers an area of 27.8 million hectare having a production of 99.87 million tones with a productivity of 31.25 quintal per hectare it contributes about 34 per cent of the total food grain production of the country (Department of Agriculture, Cooperation and Farmers Welfare 2017-18).

Wheat is grown in all the states in India except Southern and North Eastern states. Uttar Pradesh, Haryana, Punjab, Rajasthan are the major wheat producing states and accounts for almost 80% of total production in India. Only 13% area is rain fed. Major Rain fed wheat areas are in Madhya Pradesh, Gujarat, Maharashtra, West Bengal and Karnataka. Central and Peninsular Zone accounts for total 1/3rd of wheat area

in India. All India basis only 1/3 irrigated wheat receives desired irrigations and remaining is limited irrigation only.

Uttar Pradesh is one of the important states in India producing 32% of total wheat production in the country. It is adaptable to different soils, climates and elevation. The wheat production has been increasing from year to year after the Green Revolution in India. The increase in wheat production in India is not the result of just an increase in the area of cultivation, but also due to higher yields per hectare. After the Green Revolution the yield per hectare of wheat in India increased from 14.1 quintal per hectare to 25.80 quintal per hectare on the farm of major wheat growing states.

The adoption of improved wheat production technologies resulted in a "wheat revolution" increasing

Effect of Farm Yard Manure (FYM), Phosphorous Solubilizing bacteria (PSB) and Sulphur on Growth and Yield of Mungbean [*Vigna radiata* (L.) Wilczek] along with Soil Sustainability

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ABSTRACT

An experiment was conducted during 2020 to investigate the effect of farm yard manure (FYM), phosphorous solubilizing bacteria (PSB) and Sulphur on the growth and yield of mungbean along with soil sustainability. The various treatments applied to mungbean were control i.e., RDF (T₁), RDF + FYM @ 5 tons ha⁻¹ (T₂), RDF + FYM @ 5 tons ha⁻¹ + PSB (T₃), RDF + FYM @ 5 tons ha⁻¹ + PSB+ 40 kg Sulphur (T₄), 125% RDF (T₅), 125% RDF + FYM @ 5 tons ha⁻¹ (T₆) and 125% RDF + FYM @ 5 tons ha⁻¹ + PSB (T₇). Significantly higher growth parameters like plant height, number of branches plant⁻¹, dry matter accumulation plant⁻¹, number of nodules plant⁻¹ was observed with 125% RDF + FYM @ 5 tons ha⁻¹ + PSB (T₇). Significantly higher yield parameters like number of pods plant⁻¹, number of seeds pod⁻¹, test weight, seed and stover yield and protein content was also observed with 125% RDF + FYM @ 5 tons ha⁻¹ + PSB (T₇). Soil sustainability in terms of soil pH, EC, organic carbon, NPK availability and uptake was also noticed significantly superior in T₇.

Key words: *Vigna radiata*, Phosphorus solubilizing bacteria (PSB), FYM, Growth, Yield, Nutrient uptake

Pulses are an important source of dietary protein throughout the world. As per the World Health Organization (WHO) and FAO per capita per day requirement of pulse in the human diet is 80g, but the production and availability of pulses declined, which is a serious concern in the present scenario. By contributing 25.5% of total global pulse production, India ranks first in both production as well as consumption of pulses at the global level. Apart from those pulses are important for farming system sustainability because of their roles in atmospheric nitrogen fixation with the help of symbiotic bacteria like *Rhizobium*. Mungbean (*Vigna radiata* L.) is one of the third most important pulse crops in India after chickpea and pigeon pea. It is an outstanding source of protein (25%) with higher content of lysine (460 mg/g) and tryptophan (60 mg/g). In India, the pulses are cultivated mainly in rainfed conditions. In 2017-18 total pulse production was 25.23 million tonnes from 29.99 million ha area (Directorate of Economics and Statistics). In the year 2017-18 total area under mungbean in India was 4.1 million ha with an overall production of 1.9 million tonnes (Ministry of Agriculture and Family

Welfare). More than 80 per cent of mungbean production comes from Rajasthan, Madhya Pradesh, Maharashtra, Bihar, Karnataka, TN, Gujarat, Andhra Pradesh, Odisha and Telangana. The total area under Mungbean during the 11th plan was 33.32 lakh ha, whereas it was decreased to 30.41 lakh ha during the 12th plan and productivity was 468 kg ha⁻¹ [1]. Organic manure like FYM is well recognized for improving macro and micronutrients availability. It provides 0.5% N, 0.2% P₂O₅ and 0.5% K₂O. It improves soil health through its beneficial effect on amending the physical, chemical and biological properties of soil. FYM facilitates in proper aeration and water holding capacity of the soil and helps in the more efficient utilization of chemical fertilizers. Apart from that, it helps in increasing the population of soil micro-organisms that enhances the availability of plant nutrients in the soil. Insoluble reserves of phosphorus are made available to plants after solubilization by PSB like *Pseudomonas* and *Bacillus*. Beneficial microbes' resident to the rhizosphere are receiving greater attention, as they can solubilize inorganic phosphate into soluble form through the process of acidification, chelation, exchange reactions and production of organic acids [2]. In addition, these phosphate solubilizing microorganisms (PSMs) can also increase the growth of plants by other mechanisms i.e., production of phytohormones such as IAA [3] which promotes plant growth. Fungi were more efficient than bacteria in solubilizing insoluble phosphate [4]. Although, strains of *Aspergillus* and *Penicillium* spp. are the most common fungi

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Effect of Sulphur and Zinc Nutrition on Growth and Yield Performance of Mustard (*Brassica juncea* L.) and Soil Properties

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ABSTRACT

An experiment was undertaken on sandy loam soil at the research plot of Udai Pratap Autonomous College Varanasi with mustard variety VARUNA as a test crop during *Rabi* season (2019-2020) to study the effect of Sulphur and zinc nutrition on the growth and yield performance of mustard (*Brassica juncea* L.) and soil properties. The experiment comprised of T₁ (control), T₂ (NPK + 8 kg Zn ha⁻¹), T₃ (NPK + 10 kg Zn ha⁻¹), T₄ (NPK + 12kg Zn ha⁻¹), T₅ (NPK + 40 kg S ha⁻¹), T₆ (NPK + 40kg S + 8 kg Zn ha⁻¹), T₇ (NPK + 40 kg S + 10 kg Zn ha⁻¹). Significantly higher plant height (141.62 cm), number of branches (80.40 plant⁻¹), number of seed siliqua⁻¹ (14.87), number of siliqua plant⁻¹ (117.33 cm), seed yield (13.49 q ha⁻¹) and stover yield (38.35 q ha⁻¹) and nutrients consumption was recorded where 40 kg S + 10 kg Zn ha⁻¹ was applied. Application of 40 kg S + 10 kg Zn ha⁻¹ registered significantly higher nutrient uptake (NPK S) and soil available nutrients (NPK S and Zn).

Key words: Soil properties, Soil fertility, Nutrient uptake, Mustard, Growth, Yield

Among oilseed crops, after soybean (*Glycine max*) and palm (*Elaeis guineensis*), Rapeseed-mustard is the third most prominent crop. India produces around 6.7mt of rapeseed-mustard next to China (11-12mt) and the European Union (10–13mt) with a significant contribution to the world rapeseed-mustard industry. In India mustard (*Brassica juncea* L.) is mostly cultivated in states like Rajasthan, UP, Haryana, Madhya Pradesh, and Gujarat. Apart from that, it is also cultivated in south Indian states like Karnataka, Tamil Nadu, and Andhra Pradesh. This crop can be cultivated under both irrigated and rainfed conditions. Proper nutrient management under mustard increases the seed and oil yields by improving the setting pattern of siliqua on branches, the number of siliqua plant⁻¹, and other yield attributes. Sulphur is a vital component of essential amino acids. In general, the amount of S taken up to produce one ton of economic yield (main produce) is considered to be 12 kg for oilseeds. Sulphur fertilization significantly improves various quality parameters within the plant system. Application of S in combination with balanced amounts of other nutrients significantly increased the oil content of *Brassica* spp. (5-6%) and also the protein content. Zinc is one of the first micronutrients recognized as essential

for plants that are transported to plant root surface through diffusion [1]. Zn is a micronutrient and in case of its severe deficiency, the symptoms may last throughout the entire crop season [2]. Zn deficient plant also appears to be stunted [3] as a result approximately 2 billion people suffer from Zn deficiency all over the world [4]. The grain yield can be improved by the addition of Zn fertilization [1]. The highest stover yield (2770 kg ha⁻¹) with Zn and almost the same trend of seed yield [5]. The seed yield can be improved by the addition of Zn fertilization. Keeping above mentioned facts in mind, this experiment has been undertaken to evaluate the effect of Sulphur and zinc nutrition on the growth and yield performance of mustard (*Brassica juncea* L.) and soil properties.

MATERIALS AND METHODS

This field experiment was carried out in *Rabi* season (2019-20) at the agricultural farm of U. P. Autonomous College, Varanasi developed on alluvium deposited soil. The soil was sandy clay loam in texture, slightly saline and non-alkaline in reaction. The initial physiochemical properties of experimental soil were bulk density 1.42 g cm⁻³, particle density 2.65 g cm⁻³, pH (1:2.5) 7.85, EC 0.21 dS m⁻¹, organic carbon 0.44%, water holding capacity 43.5%, available nitrogen 259.26 kg ha⁻¹, available phosphorus 12.5 kg ha⁻¹, available potassium 159.26 kg ha⁻¹ and available Sulphur 14.58 kg ha⁻¹. The various treatments applied to the mustard crop were Control (T₁), 8 kg Zn ha⁻¹ + RDF (T₂), 10 kg Zn ha⁻¹ + RDF (T₃), 12 kg Zn ha⁻¹ + RDF (T₄), 40 kg S ha⁻¹ + RDF (T₅), 40 kg S ha⁻¹ + 8 kg Zn ha⁻¹ + RDF (T₆) and 40 kg S ha⁻¹ + 10 kg Zn ha⁻¹ + RDF (T₇). The treatments were triplicated in a randomized block design. The recommended dose for mustard was 60:30:40

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Effects of Copper Nutrition on Production Potential and Nutrients Uptake by Wheat (*Triticum aestivum* L.) Crop

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ABSTRACT

This field experiment was carried out on sandy loam soil with wheat variety HD 2967 as a test crop during *Rabi* season (2019-2020) to study the effects of copper nutrition on production potential and nutrients uptake by wheat (*Triticum aestivum* L.) crop. The experiment comprised of Control (T₁), 0.5 kg Cu ha⁻¹ + RDF (T₂), 1.0 kg Cu ha⁻¹ + RDF (T₃), 1.5 kg Cu ha⁻¹ + RDF (T₄), 2.0 kg Cu ha⁻¹ + RDF (T₅) and 2.5 kg Cu ha⁻¹ + RDF (T₆). Highest plant height (92.75 cm) at 120 DAS, number of tillers (441 tiller m⁻²) at 60 DAS, number of leaves (64.53 leaves plant⁻¹) at 60 DAS, number of grains (42.41 grains per ear head), spike length (18.23 cm), test weight (38.67 gm), grain yield (45.98 q ha⁻¹), straw yield (76.98 q ha⁻¹), biological yield (122.96 q ha⁻¹) and harvest index (37.39%) of wheat were obtained with T₅ treatment followed by T₅>T₆>T₄>T₃>T₂>T₁. Among various treatments, the nutrients (NPK and Cu) uptake by wheat were recorded highest under 2.5 kg Cu ha⁻¹ + RDF (T₅) treated plot and lowest under control (T₁).

Key words: Wheat, Growth, Yield, Nutrient uptake

Wheat (*Triticum aestivum* L.) is the cereal crop with the most widespread cultivation around the world due to its wider adaptability to different agro-climatic and soil conditions. It is consumed in various forms by more than one thousand million human beings in the world. It is the most important staple food of about two billion people (36% of the world population). It is an important industrial crop and is a main raw material in feed mills with bread, cake, biscuits, pasta, spaghetti, Dalia, halva, sweets and the formation of a high-quality alcohol-containing reasonable amount of wheat. Worldwide, wheat provides nearly 55% of the carbohydrates and 20% of the calories consumed in the world's food supply. Wheat contributes more protein (8-15%) to the diet than any other cereal and it has a relatively high content of niacin and thiamine. Today, India ranks second in wheat production with a harvest of 102.19 million tonnes and an area is 29.14 million hectares during 2018-2019 (Directorate of Economics & Statistics). China leads the world, in terms of area under wheat cultivation, followed by India, Russia and the USA. Micronutrient deficiency has become a major constraint for crop productivity in many Indian soils. Copper is one of the essential micronutrients for plants. Cu plays an important role in regulating multiple biochemical reactions, so plant growth is highly dependent on its availability. Copper also influences on the metabolic processes of plant-like photosynthesis and

reduction of respiration in pollen capability and its deficiency increases infertility of spikelet in a lot of unfilled grains [1]. Soil applied Cu significantly increases the grain yield of wheat [2]. Copper sulphate is used as an antifungal agent in many pesticides. The excess of copper affects the activity of enzymes, it impairs the DNA, the protein oxidation and the integrity of membranes which alters the photosynthesis, and it damages plasma membranes and produces functional changes and other metabolic disorders [3-4].

MATERIALS AND METHODS

A field experiment was conducted in *Rabi* season (2019-20) at the agricultural farm of U.P. Autonomous College, Varanasi developed on alluvium deposited soil. The texture of the soil at the experimental site was sandy clay loam and in response, it's slightly saline and non-alkaline. The initial physicochemical properties of experimental soil were bulk density 1.43 g cm⁻³, particle density 2.65 g cm⁻³, pH (1:2.5) 7.42, EC 0.35 dS m⁻¹, organic carbon 0.35%, water holding capacity 43.5%, available nitrogen 173 kg ha⁻¹, available phosphorus 13.6 kg ha⁻¹, available potassium 183.36 kg ha⁻¹ and DTPA-extractable copper 3.82 kg ha⁻¹. The various treatments applied to wheat crop were Control (T₁), 0.5 kg Cu ha⁻¹ + RDF (T₂), 1.0 kg Cu ha⁻¹ + RDF (T₃), 1.5 kg Cu ha⁻¹ + RDF (T₄), 2.0 kg Cu ha⁻¹ + RDF (T₅) and 2.5 kg Cu ha⁻¹ + RDF (T₆). The treatments were tetra replicated in a randomized block design (RBD). The recommended dose for wheat was 120-60-40 kg N-P₂O₅-K₂O ha⁻¹. The crop received a differential dose of Cu from inorganic fertilizer as per treatments. Nitrogen from urea was given as 50% basal, 25% after 45 days of sowing and 25% after

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Cropping geometry and nutrient management study on winter maize (*Zea mays*) + potato (*Solanum tuberosum*) intercropping

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ABSTRACT

Field experiment was conducted during *rabi* during 2015-16 and 2016-17 at Varanasi (UP) to study the effect of cropping geometry and nutrient management on winter maize (*Zea mays* L.) + potato (*Solanum tuberosum* L.) intercropping. Among the crop geometry, winter maize intercropped with potato (1:1) in replacement series showed significantly higher growth parameters of maize, viz. dry matter accumulation, crop growth rate and number of green leaves per plant as compared to additive series but it was found at par when winter maize grown with potato (1:2) in replacement series. However, growth parameters of potato differed interchangeably as compared to maize in winter maize + potato intercropping system during both the years. Significantly higher grain yield of winter maize and potato were found in intercropping with 1:1 and 1:2 in additive series, respectively. Assessment of intercropping indices and economics of maize and potato proved to be better in additive series as compared to replacement series during both the years of experimentation. Amongst nutrient management, growth parameters, yield attributes and yield, intercropping indices and economics of winter maize + potato were recorded significantly higher with the application of 100% RDF + 25% N through poultry manure followed by the application of 100% RDF + 25% N through vermicompost as compared to rest of the treatments during both the years. Thus, it may be concluded that the maize + potato intercropping in additive series with integration of poultry manure as N source gives better yield and economics of both the crops.

Keywords: Equivalent yield, Intercropping, Land equivalent ratio, Potato, Winter maize

One way to improve the land use efficiency (LUE) is through intercropping of companion crops including winter maize (*Zea mays* L.) and potato (*Solanum tuberosum* L.). Because of being a slow growing (especially during winters) and wide row crop, winter maize provide sufficient time and space in the field to incorporate short duration intercrops. Potato, because of similar cultural requirements (especially earthing up and furrow irrigation) fits best as intercrop in winter maize. At the same time rational crop community structure plays an important role in maximizing the intercropping yield advantage. The proportion of component crops in intercropping is a vital factor for reducing the risk to the component crop during adverse weather conditions. Therefore, optimization of plant population (row ratio) of component crops is one of the thrust areas of research in intercropping systems to maximize returns per unit area.

Continuous use of only chemical fertilizers in intensive cropping system is leading to imbalance of nutrients in soil, which has an adverse effect on soil health and also on crop yields. But use of organics alone does not result in spectacular increase in crop yields due to their low nutrient content and slow availability (Kumar *et al.* 2016). Complementary use of biological sources of plant nutrient along with chemical fertilizer is of great importance for the maintenance of soil health and productivity of crop from per unit area of land. In which, integrated nutrient management entails the maintenance/adjustment of soil fertility to an optimum level for enhancing the crop productivity to get the maximum benefit from all possible combination sources of nutrients – organic as well as inorganic – in an integrated manner (Shukla *et al.* 2013). Keeping all these facts in view, an experiment was conducted to investigate the effect of crop geometry and nutrient management on winter maize + potato intercropping under irrigated conditions.

MATERIALS AND METHODS

Field experiment was conducted during the winter (*rabi*) season of 2015–2016 and 2016–17 at the Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (UP). Geographically,

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Productivity and energetics of rice (*Oryza sativa*) based cropping systems in Indo-Gangetic plains

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ABSTRACT

A field experiment was conducted at the Agricultural Research Farm, Banaras Hindu University, Varanasi, Uttar Pradesh during 2016–17 and 2017–18 to study the productivity and energetics of rice (*Oryza sativa* L.)-based cropping systems under irrigated condition. The experiment was conducted in randomized block design with three replications. The treatment comprised ten rice-based cropping sequences. Results revealed that rice-potato-green gram recorded significantly high system rice equivalent yield over rest of the cropping sequences during both the years of study. Energy input was recorded highest in rice-potato-green gram followed by rice-potato-cowpea fodder, rice-mustard-sudan grass fodder, rice-wheat-cowpea fodder and lowest in rice-berseem-cowpea fodder sequence. Rice-mustard-sudan grass fodder sequence recorded significantly high energy output, net energy, energy output-input ratio and energy intensity as compared to rest of the cropping sequences during both the years of investigation, whereas energy productivity was high in rice-cabbage-cowpea fodder sequence compared to other sequences during both the years of experimentation. However, specific energy was higher in rice-wheat-green gram sequence than rest of the cropping sequences except rice-wheat sequence during second year of investigation where it remained at par with rice-wheat-green gram sequence.

Keywords: Energy Intensity, Energy Productivity, Rice, Specific Energy

Rice (*Oryza sativa* L.)-wheat (*Triticum aestivum* L.) is the predominant cropping system in India. It is considered as backbone of food security in South-east Asia (Baghel *et al.* 2018). In the era of shrinking resource base of land, water and energy, resource-use efficiency is an important aspect for considering the suitability of a cropping system (Yadav 2002, Ray *et al.* 2020). In the high productivity zone of the Indo-Gangetic Plains (IGP), continued practice of the rice-wheat system for over four decades has posed a serious threat to agricultural sustainability (Bhatt *et al.* 2016, Singh *et al.* 2019). Under existing agro-climatic situation of Varanasi region particularly in low land condition, complete replacement of rice by any other crop is practically not feasible. However, there is possibility of diversifying rice-wheat system by growing oilseeds, grain legumes as well as some short duration vegetable and fodder crops particularly under integrated farming system. Energy is the basic need of human life and main stay of economy. However, the energy use in crop production

had not been given adequate importance in earlier years, but more emphasis must be laid on renewable and non-commercial sources of energy, that are actively involved in crop production processes using intensive energies directly or indirectly. Crop production is often considered as an energy conversion industry. Through photosynthesis plants convert solar and chemical energy derived from the soil into storable chemical energy as carbohydrates, fats, proteins as well as all cellulose. Excessive use of energy results in high unit cost of production, loss of income and market competitiveness (Kachroo *et al.* 2012). Therefore, crop diversification needs to be designed in such a way that apart from higher productivity and profitability it must be an efficient converter of energy. Hence, in the present investigation ten different rice-based cropping sequences were evaluated to find the options for higher productivity and energy efficient rice based cropping sequence under irrigated condition of eastern Uttar Pradesh.

MATERIALS AND METHODS

A field study was carried out at the Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during 2016–17 and 2017–18, as a part of ongoing experiment under Varanasi centre of AICRP on Integrated Farming System initiated during 2016–17. The soil of the experimental field was alluvial deep, slightly alkaline (pH 7.95), moderately fertile

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Residual effect of integrated nutrient management practiced in sudan grass on growth and yield of succeeding fodder oat

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ABSTRACT

Field experiments were conducted at B.H.U., Varanasi, Uttar Pradesh, India during 2015-16 and 2016-17 to evaluate the residual effect of INM practiced in *kharif* sudan grass on growth and yield of succeeding fodder oat crop. Treatments comprised combination of two inorganic fertility levels viz. 75% RDF and 100% RDF, and four levels of organic manures viz. 20 kg Nha⁻¹ through FYM, 20 kg Nha⁻¹ through vermicompost, 40 kg Nha⁻¹ through FYM, 40 kg Nha⁻¹ through vermicompost laid out in factorial RBD with three replications. Among two inorganic fertilizer levels, maximum growth and yield of oat was registered under 100% RDF. The application of organic manures in preceding sudan grass also had significant effect on succeeding oat crop. The maximum plant height, tillers count/linear meter, leaf area index, dry matter accumulation, green fodder yield (569.51 qha⁻¹) and dry fodder yield (113.63 qha⁻¹) were recorded with the application of 40 kg N ha⁻¹ through FYM to preceding sudan grass. Though it remained at par with application of 40 kg Nha⁻¹ through FYM but proved significantly superior to application of 20 kg Nha⁻¹ through FYM and application of 20 kg Nha⁻¹ through vermicompost. Thus, it may be concluded that the application of organic manures had long term positive effects succeeding oat crop.

Key words: INM, RDF, oat, sudan grass, residual effect, growth, yield.

Livestock is the main segment of Indian agriculture and contributes roughly 28.63 per cent of value of the output at current prices of total value of output in agriculture and allied sector.

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The entire contribution of livestock sector in total GDP was roughly 4.19 percent during 2018- 19 (Economic survey, GOI, 2021). Appropriate and timely availability of feed determines the success and prosperity of livestock farming, but insufficient year-round fodder availability limits dairy production in India making it the country with the highest cattle population (20 per cent) and one of the lowest cattle productivity (DAHD, GOI, 2020). The green forages are major and the most economical source to fulfill the dietary needs of livestock but in India, cultivated fodder is limited to 4.9% of the total cropped area (Kumar *et al.* 2012). The chronic fodder shortage, most serious in winter during which traditional winter fodder crops like berseem are dormant, is a major limiting factor for livestock production

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जुलाई 2022

डाउन टू अर्थ

पर्यावरण और विकास की राजनीति... हर महीने

₹ 50

चारे का 'अकाल'

भारत में क्यों महंगाया चारा संकट? इसके क्या
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सरकारी नीतियों में हाशिए पर रहा चारा उत्पादन

आंकड़ों के अभाव में चारा संकट की समस्या को नकारना आसान है परंतु इससे समस्या का समाधान नहीं होता

देव नारायण सिंह

विश्व की लगभग 20 प्रतिशत पशुधन आबादी वाले देश भारत में सूखे चारे विशेषतः गेहूँ के भूसे एवं धान के पुआल की कीमतें पिछले वर्ष की तुलना में 2 से 3 गुना तक बढ़ गई हैं। भूसे की कीमतों में बढ़ोतरी की वजहें स्थानीय हैं। सामान्य बाजार में किसी वस्तु की कीमतें उसकी मांग व उपलब्धता पर निर्भर करती हैं। भूसे एवं चारे की उपलब्धता में कमी के कारणों पर गौर करें तो पता चलता है कि इस समस्या के तात्कालिक कारणों के साथ-साथ बहुत से ऐसे कारण भी हैं जिनका संचित परिणाम आज इस चारा संकट के रूप में उभरा है।

तात्कालिक कारणों में प्रमुख रूप से गेहूँ के रकबे में कमी व जलवायु परिवर्तन के असर से उत्पादन में कमी है। पिछले वर्ष के 336 लाख हेक्टेयर की तुलना में इस वर्ष केवल 317 लाख हेक्टेयर क्षेत्रफल पर ही गेहूँ की फसल उगाई गई। इसके पीछे की प्रमुख वजह घटते भूमिगत जल स्तर से महंगी होती सिंचाई व बढ़ती लागत के कारण किसानों का कम लागत व कम पानी चाहने वाली फसलों जैसे चना व सरसों की तरफ आकर्षित होना है। खाद्य तेलों की बढ़ती कीमतें भी सरसों की खेती के आकर्षण का प्रमुख कारण हैं। इसके अलावा गेहूँ की फसल की कटाई हेतु लगातार बढ़ते मशीनों के प्रयोग विशेषतः कंबाइन हार्वेस्टर ने भी भूसे की कमी को बढ़ाने में अहम भूमिका अदा की है। हाथ से फसल काटकर श्रेसर से मड़ाई करने की तुलना में कंबाइन से कटाई-मड़ाई पर लगभग आधा ही भूसा प्राप्त होता है। हालांकि कंबाइन के प्रयोग को बढ़ावा देने में कटाई हेतु मजदूरों की कमी व इसके पीछे सरकारों द्वारा दिए जा रहे मुफ्त राशन और मनरेगा जैसी योजनाओं का योगदान भी कुछ कम नहीं है। पिछले कुछ वर्षों में पशुओं के चारे हेतु धान के पुआल की कट्टी की उपलब्धता व प्रयोग भी घटा है। इसके पीछे की वजह भी मशीनों से फसल कटाई है, जिसमें केवल बालियां काट ली जाती हैं और पुआल/पराली को खेत में ही जला दिया जाता है।

आज से एक-डेढ़ दशक पहले की बात करें तो अधिकांश पशुपालक साल के तीन-चार महीने जानवरों को धान के पुआल की कट्टी ही खिलाते थे। लेकिन आज पूर्णतया भूसे पर निर्भर रहते हैं, जिससे भूसे की मांग अप्रत्याशित रूप से बढ़ती जा रही है। भूसे की बढ़ती मांग की एक वजह हमारे देश की बढ़ती पशुधन आबादी भी है जो 0.66 प्रतिशत प्रतिवर्ष की दर से बढ़ रही है। 53.6 करोड़ पशुधन आबादी वाले देश में भूसे की आसमान छूती कीमतों का एक कारण यह भी है कि हमारे यहां अधिकांश मवेशी सूखे चारे यानी भूसा या पुआल, ज्वार-बाजरा की कर्वी एवं राशन (मोटे अनाजों या चावल की कन, चोकर आदि) पर ही निर्भर रहते हैं। क्योंकि हरे चारे की उपलब्धता बहुत कम है। इसके अलावा बढ़ती आबादी ने सार्वजनिक भूमियों जिनका उपयोग पहले चारागाह के रूप में किया जाता



था, पर भी भवन निर्माण व औद्योगिक इकाइयों के निर्माण हेतु कब्जा करके भूसे पर निर्भरता बढ़ाने का काम किया है। भूसे के बढ़ते औद्योगिक उपयोग (कागज एवं ईट भट्टे आदि में) ने भी आग में घी डालने का काम किया है।

हरे चारे की उपलब्धता कम होने की अपनी अलग वजहें हैं। विश्व की 17.5 प्रतिशत मानव आबादी वाले देश के पास मात्र 2.3 प्रतिशत भूमि है, ऐसे में वह इस सीमित भूमि को खाद्य फसलों की खेती हेतु प्रयोग करें या चारा उत्पादन हेतु? हालांकि जितनी जरूरी खाद्य फसलें हैं, उतना ही आवश्यक पशुधन का चारा भी है।



परंतु अधिकांश सरकारों ने इस ओर अपेक्षित ध्यान नहीं दिया, तथा चारा उत्पादन सरकारी नीतियों में हाशिए पर ही रहा है। शायद यही वजह है कि विश्व की सबसे अधिक पशुधन आबादी वाले देश में चारा उत्पादन, उपलब्धता, मांग व खपत के आधिकारिक आंकड़े प्रतिवर्ष जारी नहीं किए जाते। आंकड़ों के अभाव में सरकारों के लिए चारा संकट की समस्या को नकारना तो आसान है परंतु इससे समस्या का समाधान नहीं होता।

हरे चारे की कमी की प्रमुख वजह बहुत कम क्षेत्रफल (4 प्रतिशत कृषि योग्य भूमि) पर सीमित संसाधनों से दोयम दर्जे के प्रबंधन के अंतर्गत इसकी खेती करना है। उच्च उत्पादन क्षमता वाली चारे की फसलों के गुणवत्तापरक बीजों की अनुपलब्धता भी एक प्रमुख कारण है। हरा चारा सूखे चारे की अपेक्षा अधिक पौष्टिक होता है और इसकी उपलब्धता बढ़ाकर न केवल भूसे की बढ़ती कीमतों पर लगाम लगाया जा सकता है बल्कि दूध उत्पादन भी बढ़ाया जा सकता है। लुसर्न, बरसीम, जौ, जई, सूडान चरी, एमपी चरी, अप्रनीकन मक्का, नेपियर घास, शुगर ग्रेज आदि हरे चारे की फसलें हैं, जिन्हें साल के विभिन्न मौसमों में आवश्यकता अनुसार उगाकर चारा संकट को बहुत हद तक कम किया जा सकता है। परंतु यह सरकारों, वैज्ञानिकों व पशुपालक किसानों के संयुक्त प्रयास से ही संभव है। इसके लिए सरकारों को चाहिए कि भूसे के औद्योगिक उपयोग पर प्रतिबंध लगाएं, हरे चारे के उत्पादन को बढ़ावा देने व चारागाहों के विकास हेतु उचित नीतियां बनाएं तथा चारा उत्पादक किसानों को प्रोत्साहन दें। वैज्ञानिकों को हरे चारे की फसलों की उन्नतशील प्रजातियां विकसित करनी होंगी तथा सीमांत व कृषि आयोग भूमियों में कृषि वानिकी के तहत चारा उत्पादन की तकनीक विकसित करनी होंगी तथा पशुपालक किसानों को भूसे पर निर्भरता कम करने व हरे चारे के उत्पादन पर ध्यान देना होगा। लघु एवं सीमांत किसान खेत की मेड़ों पर नेपियर घास जैसी चारे की बहुवार्षिक फसलें उगा कर कुछ हद तक चारे की समस्या को दूर कर सकते हैं।

(लेखक उत्तर प्रदेश के वाराणसी में स्थित उदय प्रताप स्वायत्तशासी महाविद्यालय में सस्य विज्ञान विभाग के सहायक प्राध्यापक हैं)

REVIEW ARTICLE

A review of India's fodder production status and opportunities

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Abstract

This review paper aims at an in-depth analysis of the challenges, opportunities, and status of fodder production in India. A comprehensive review of available literature and various reports by govt. as well as non govt. organizations have been done as part of the methodology for preparing the manuscript. India caters to approximately 20% of the world's livestock population and about 17.5% of the human population on just 2.3% of the world's land area. The human population is increasing at a pace of 1.6% per annum, while the livestock population is increasing at a rate of 0.66% per year. These increasing human and animal populations are fighting tooth and nail for land resources for food and fodder production, respectively. As a result, cultivated fodders occupy only 4% of the entire cultivable land in the country. Presently, the country faces a net shortfall of 35.6% green fodder, 10.5% dry crop leftovers, and 44% concentrate feed ingredients. The option for increasing land area under fodder cultivation is very limited. Hence, it is big challenge in front of us to utilize the available meagre land wisely with its fullest potential to produce the fodders for the animals. Which could be achieved by adopting suitable cropping systems, incorporation of fodder crops in food and other cash crop-based cropping systems on rotational basis, production of fodder on degraded lands by adopting fodder-based agro forestry systems and exploring other options of green fodder like azolla. The cropping system with forage crops provides a potential alternative to overcome the fodder problem as it utilizes the resources more efficiently.

KEYWORDS

azolla, cropping system, fodder production, hydroponics, livestock

1 | INTRODUCTION

Agriculture and animal husbandry are culturally, religiously, and economically intertwined with the intricate fabric of human society, as mixed farming and livestock rearing are a vital element of rural life (Dagar, 2017). Draught power, rural transportation, manure, fuel, milk and meat all are provided by livestock, which is quite often the only source of monetary revenue for subsistence farmers and also act as insurance against the crop failure. It also directly affects the livelihood and food security of nearly a billion people around the world and affects the diet and health of many more (Downing et al.,

2017; Hurst et al., 2005). For millennia, livestock has been a symbol of wealth and power across civilizations, and India is lucky to have the world's largest and most diverse livestock population. Around 70% of households rely on the livestock and agriculture sector for their livelihood (Ghosh et al., 2016). According to the 20th Livestock Census - 2019, India's total livestock population is 535.82 million, up by 4.6% from the previous Census in 2012. Cattle, buffalo, mithun and yak make up the 302.82 million bovine populations. It is home to 57.3% of the world's buffalo population and 14.7% of the world's cattle population. In the country, there are around 74.26 million sheep and 148.8 million goats (20th Livestock Census-2019, 2019).

Growing more rice with less water

Deo Narayan Singh and Tejram Banjara

*Rice (*Oryza sativa*) is the staple food of more than half of the population in the world. It is an important target to provide food security and livelihoods for millions. Imminent water crisis, water-demanding nature of traditionally cultivated rice and climbing labour costs have necessitated the search for alternative management methods to increase water productivity, system sustainability and profitability. Considering the food basket of India, rice cannot be replaced by other arable crops. To withstand the scarcity of water, growing direct seeded rice (DSR) is one of the best options for areas where rainfall does not support the cultivation of conventional rice. DSR refers to the process of establishing the crop from seeds sown in the field rather than by transplanting seedlings from the nursery. Direct seeding avoids three basic operations, namely puddling (a process where soil is compacted to reduce water seepage), transplanting and maintaining standing water; thus it saves water, labour and time.*

The amount of freshwater available on the planet is limited, but demand for that finite water is growing. For at least part of the year, four billion people – or 66% of the world's population faces extreme water shortage. One billion of these people live in India, while 0.9 billion live in China. A staggering 180 million people in India face severe water scarcity all year round¹. Burgeoning population and changing food habits from vegetarian to non-vegetarian make this limited resource scarcer day by day. Therefore, the pressure to reduce water use in irrigated agriculture is mounting, especially in Asia where it accounts for 90% of total freshwater consumption. Rice as a main food crop for more than three billion people² supplements the major carbohydrate and even protein demand not only in Southeast Asia, but also in some parts of Africa^{3,4}, and thus becomes an obvious target when it comes to agricultural water conservation. It is grown in more than 30% of irrigated land and uses 50% of irrigation water. According to Toung and Bouman⁵, 39 m ha of irrigated rice in Asia can face physical or economic water scarcity by 2025. If the water saved can be delivered to areas where consumption is high, reducing water input in rice production can have a significant societal and environmental effect. A 10% decrease in the amount of water used in irrigated rice will free up to 150,000 million m³, or around 25% of the total freshwater used for non-agricultural purposes globally.

When the International Water Management Institute's (IWMI) water scarcity atlas and International Rice Research Institute's (IRRI) rice region maps are combined, it can be clearly observed that wet-season irrigated rice areas in North China (2.5 m ha), Pakistan (2.1 m ha), and North

and Central India (8.4 m ha) will face physical water scarcity by 2025. The groundwater table is also decreasing at an average rate of 1–3 m/yr in the North China plains, 0.5–0.7 m/yr in the Indian states of Punjab, Haryana, Rajasthan, Maharashtra, Karnataka and northern Gujarat, and about 1.0 m/yr in Tamil Nadu and hard rocks of southern India resulting in water shortage and rising pumping costs^{6–9}.

Dry direct seeded rice

Irrigated lowland rice is the most important agricultural system in Asia, wherein the rice is transplanted into puddled paddy fields. Soaking, ploughing and harrowing of saturated soil are the steps involved in land preparation. The fields are kept submerged with 5–10 cm of water after crop establishment. Since the water is used for wetland preparation and due to huge losses by seepage, percolation and evaporation, the production of lowland rice needs a significant amount of water (~150 cm), of which 15–20 cm is used for puddling¹⁰. According to Chauhan and Opena¹¹, puddling in transplanted–flooded rice systems consumes up to 30% of the total rice water requirement. The conventional method of rice cultivation (transplanting in puddled fields) uses about 5000 l of water to produce 1 kg of rice, rather than the actual requirement of 3000 l (ref. 12). Due to constant flooding of the fields, about 2000 l of water is lost by evaporation and seepage¹³. However, in rice–rice cropping systems, puddling is beneficial because it decreases soil permeability, creates hardpans and reduces water loss by percolation. Nonetheless, repetitive puddling operations damage the successive non-rice


upland crop in rotation by dismantling soil aggregates, decreasing permeability in subsurface layers and forming hardpans at shallow depths^{14,15}. The continuous submergence of soil also encourages the anaerobic decomposition of organic matter which produces methane, an important greenhouse gas.

In light of these contradicting demands and constraints scenario, the question arises whether rice needs standing water for optimal production. Flooding in rice is used as a management tool rather than a necessity. As a result, new rice-based systems that are socially appropriate, economically viable and environmentally sustainable must be developed for rice production to be sustained or increased in the face of decreasing water availability.

An alternative to puddled transplanting of rice could be aerobic direct seeding because it requires less water, labour and capital input¹⁶. The concept of aerobic rice was first developed in China. IRRI defines aerobic rice as a production system in which especially developed 'aerobic rice' varieties are grown in well-drained, non-puddled and unsaturated soils. Suitable areas for aerobic rice cultivation include irrigated lowlands where rainfall is insufficient to sustain rice production, delta regions where there is delay in water release from reservoirs, irrigated system of rice cultivation where pumping from deep borewell has become expensive and favourable upland system having access to supplemental irrigation. Accordingly, Tamil Nadu, Jharkhand, Chhattisgarh, parts of Bihar, Odisha, Karnataka and eastern Uttar Pradesh; the projected areas of uneven distribution of rainfall and frequent occurrence of soil moisture limitation have good potential for DSR cultivation.

Article

Sustainability in Rainfed Maize (*Zea mays* L.) Production Using Choice of Corn Variety and Nitrogen Scheduling

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Abstract: Interestingly more than 50% of the world's area is rainfed and approximately 80% of maize is cultivated under rainfed condition where selection of cultivar and management of nitrogen have major impact on production. The aim of this study was to evaluate the growth, phenology, yield and quality parameters of maize as influenced by variety and nitrogen scheduling under rainfed condition. For this, a field experiment having two factors was laid out in a factorial randomised block design and replicated three times. The first factor was variety, i.e., V₁ (JM 216) and V₂ (JM 218), and the second was six nitrogen scheduling, i.e., N₁ to N₆, in which nitrogen splitting was done based on 30-years of average rainfall data. Variety JM 218 and N₅ [40 kg N as basal followed by (fb) 2 splits of 40 kg N and 38.8 kg N at 30 and 52 days after sowing (DAS) and 1% N foliar spray at 40 DAS] nitrogen scheduling were found promising under rainfed situation because it recorded maximum value of growth parameters, yield attributes, grain yield and quality parameters (protein, mineral and dickson quality index). Thus, it can be inferred that JM 218 and N₅ nitrogen schedule would be a better choice than alternative options.

Keywords: corn variety; rainfed; N scheduling; N foliar spray; dickson quality index

1. Introduction

The “Queen of Cereals”, maize (*Zea mays* L.), is the world's third-largest cereal crop. The multiple uses of maize as a food, fodder, feed and more recently fuel has further made it a more demand friendly and a high-value crop. Maize is the basis for food security in some of the world's poverty aligned regions of Africa, Asia and Latin America [1]. Globally, 1148.48 million metric tonnes of maize was harvested in 2019 from 197.20 million hectares of land [2]. About 73 percent of this area is located in the developing world. Maize contributes a significant portion of the food consumed by poor communities in developing countries, yet its production is insufficient to meet the requirement of poor people in these areas.

The demand of maize will be doubled by 2050 in the developing world as per Consultative Group on International Agricultural Research (CGIAR) [3]. According to the FICCI-PwC [4] report, India would require 45 million tonnes of maize output by 2022, with 30 million tonnes necessary for feed and 15 million tonnes required for food, seed, and

The assessment of Kisan mobile advisory services (KMAS) as effective way of transfer of technology in Chambal division of Madhya Pradesh

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Abstract

Kisan Mobile Advisory Services (KMAS) is one of the initiative part of the ICT tools, is employed by the Krishi Vigyan Kendra, Lahar, Bhind, (M.P.) which provide location specific and crop specific farm advisory services and facilities to farming community in a given areas. In this programme the mobile number of progressive farmers, Farmer friend, Extension officers and input dealers were registered and grouping is done as per the crop enterprises basis for facility of filtering purpose. 16568 progressive farmers were registered. The usual messages are being serving twice a week and timely information/advices are communicating as per the need based. Out of this farmer only 250 progressive farmers were selected for the studies. Result of study shows that messages was partially understandable, needful and timely, partially applicable and majority of Progressive Farmer agree with the help of this service save time and money, increase in social contact, increase in knowledge, increase in productivity and the content was fully adoptable. The study indicate that KMA is one of the most useful tool for dissemination of agriculture information to farmer and also can play a greater role in enhancing efficiency of extension service by reaching large number of peoples.

Keywords: Information and communication technologies (ICTS), Kisan mobile advisory services (KMAS), Kisan mobile sandesh (KMS)

Introduction

Dissemination of the required and recent agricultural information to the farmers in scattered villages All Over the Bhind District at the variegated geographical .The transfer of technology to farmers is not a onetime exercise because new farm technology is being constantly evolved (Mehta, 2003) now the modern information communication technologies (ICTs) as mobiles and computers have created a revolution. In the 21st century, cost effective and efficient communication technologies are required to take lead in the changing agricultural scenario. Pioneering ICT experiments in India show that rural livelihood are greatly enhanced by access to information on improved agricultural practices, pest & disease control, market & weather etc. In modern

world, information transformation transfer to the rural farmers hinges upon the tools of ICT where telecenters and mobile phones application constitute major part. Since 1990s, telecenters have been experimented with a model to provide ICT opportunities to rural communities including farmers (Barbra and Foote, 2007). Research indicates mobile access has somewhat contribute to the improvements of poor lives and supported poverty reduction (Silva and Zainudeen, 2007). Kisan mobile advisory services (KMA) is one such initiative of ICT which provide location specific and crop specific farm advisory services and facilities to the farming community in a given area. The KMA services through messages have been provided to the progressive farmers with consultation of expert of different field to improve farmer's agricultural technical knowledge with decision making ability, so that they may enable to increase their production and productivity

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PCV, GCV, Heritability (Broad Sense) and Genetic Advance Present in Tomato Germplasm With Respect to Yield and its Components Characters

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ABSTRACT

Tomato (*Solanum lycopersicum* L. = *Lycopersicon lycopersicum* L. earlier known as *Lycopersicon esculentum* Miller) is an important vegetable crop in India. The present study involved evaluation of 153 genotypes of tomato germplasm collections. The experiment was conducted in Randomized Block Design with three replications at experimental farm of Indian Institute of Vegetable Research, Adalpura, Varanasi. The data obtained on various characters were analysed for analysis of variance, mean performance of genotypes, coefficient of variability, heritability (broad sense), genetic advance and correlation coefficients. Analysis of variance for the design of experiments indicated highly significant differences among treatments for all characters. The entry CLN-1621, C-5-2, DMT-1, C-10-1 and C-13-1 produced highest yield per plant. These lines also possessed average to high mean performance for most of the yield components. In general, phenotypic coefficient of variability (PCV)

was higher than genotypic coefficients of variability (GCV) for all the characters. The highest phenotypic and genotypic coefficient of variability was observed for fruit weight, plant height, fruit width and number of fruit per plant, whereas days to first fruit setting, days to 50 % fruit setting and days to 50 % flowering showed moderate values. High estimates of heritability (85%) were observed for all traits. The high magnitude of heritability in broad sense coupled with genetic advance in percent of mean were observed for yield per plant, fruit weight, number of fruit per plant, number of branches per plant, locules, days to 50 % fruit setting, first fruit setting and days to 50 % flowering. A very strong and positive association of yield per plant was observed with days to 50% flowering, days to 50% fruit setting, days to first fruit setting, plant height, number of branches per plant, number of fruit per plant, fruit weight, fruit length, fruit width, locules, total soluble solid and yield per plant. However, number of branches per plant showed strong association with yield per plant in negative direction.

Keywords Tomato (*Solanum lycopersicum*), PCV, GCV, Genotypes, Heritability.

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INTRODUCTION

Tomato (*Solanum lycopersicum* L., $2n=2x=24$) is a very versatile vegetable for culinary purposes. Ripe fresh tomato fruit is consumed as salads and after

MORPHOLOGICAL AND PHYSIOLOGICAL VARIABILITY IN *BIPOLARIS* *SOROKINIANA**

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ABSTRACT

Variability among 6 isolates of *Bipolaris sorokiniana* (Sacc. in Sorokin) Shoem. was studied in respect of morphological and physiological variability. The isolates BS-F-5 and BS-P-3 were found to be fast growing and high sporulating. The isolates BS-DWR-K-1, BS-K-4, and BS-V-6 were found to be medium in growth and sporulation, whereas BS-D-2 was slow growing and least sporulating. Among the phosphorus sources, dipotassium hydrogen orthophosphate was best for growth and sporulation, whereas sodium phosphate was inhibitory for growth and sporulation of all isolates. Among the potassium sources, potassium nitrate was best and potassium sulphate was inhibitory for growth and sporulation of all isolates. Among the vitamins, thiamine supported maximum growth of all isolates, whereas yeast extract supported maximum sporulation. Inositol and calcium pantothenate were found to be inhibitory for growth of all isolates.

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KEYWORDS:

Morphological, physiological, *Bipolaris sorokiniana*, pH, phosphorus, potash, vitamins

The spot blotch disease of wheat caused by *Bipolaris sorokiniana* (Sacc. in Sorokin) Shoem. [syn. *Helminthosporium sativum* Pamm., King & Bakke; teleomorph: *Cochliobolus sativus* (Ito and Kurib.) Drechs. ex Dastur] (Singh *et al.*, 2001) is a destructive disease of wheat under rice-wheat system (Singh *et al.*, 2004). Pathogen variability is an important component of disease epidemiology. Though a few studies on

RESPONSE OF FOLIAR FEEDING OF MICRONUTRIENTS ON QUALITY TRAITS AND ECONOMICS OF BITTER GOURD (*MOMORDICA CHARANTIA* L.) UNDER CENTRAL ZONE OF (U.P.)

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ABSTRACT

The field experiment was conducted at Vegetable Research Farm, Kalyanpur of Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, Uttar Pradesh during *kharif* season of 2019 the response of micronutrients on different quality traits and economics of bitter gourd. The experiment was laid out in a Randomized Block Design (RBD) with three replications. Fourteen different treatments of micronutrients combination were tested against the control. Results of the experiment revealed that application of foliar feeding of mixture of all micronutrients (boric acid @ 100 ppm + zinc sulphate @ 100 ppm + ammonium molybdate @ 50 ppm + copper sulphate @ 100 ppm + ferrous sulphate @ 100 ppm + manganese sulphate @ 100 ppm) (T₇) produced significantly highest T.S.S content (5.45⁰Brix), Vitamin-C content (64.62mg/100g), Cost of cultivation (53,881.0Rs/ha.), Gross return (1,84,408.0Rs/ha.) Net return (1,30,527.0Rs/ha) and B:C ratio (3.42). Significantly highest zinc content (85 ppm), Iron content (426 ppm) and copper content (22 ppm) were found in fruits with the application of zinc sulphate @ 100 ppm (T₂), ferrous sulphate @ 100 ppm (T₅) and copper sulphate @ 100 ppm (T₄) respectively. The lowest values of quality traits and economics were recorded in control.

Key words: Bitter gourd, Quality, Micronutrients, Foliar feeding and Economic return.



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Comprehension and perception of IPM technologies between rice growing farmers in Purvanchal region of Uttar Pradesh, India

Kuldeep Singh

Abstract

A total number of 50 farmers from the 5 villages viz. Vishunpur, Gondi, Jasuri, Jeori and Tejopur were selected randomly to transfer of IPM technology in rice was undertaken in the villages of Chandauli district, in Purvanchal region of Uttar Pradesh. The IPM module for the particular region was refined and developed, validated and promoted with the use of appropriate scouting tactics, proper identification and diagnosis of insect-pests. The farmers of the selected villages were asked personally through a Questionnaire covering various aspects of IPM, socio-economic variables of farmers, comprehensions and constraints. IPM technologies have proved a track record of significantly reducing the reliance on the synthetic chemical pesticides, while improving quality, health and environmental issues. Thus the farmers were provided training on IPM technologies and were made aware of the benefit of increased productivity and reduce the pest damage.

Keywords: IPM technologies, rice, Purvanchal

Introduction

Uttar Pradesh is one of the most important rice producing states. The introduction of high yielding rice cultivars and adoption of intensive crop management practices although resulted in substantial increase in rice yields but at the same time it increased the occurrence of insect-pests (Adesina *et al.*, 1994, Bentley 1989, Kenmore *et al.*, 1987, Hobbs *et al.*, 1991, Hoeng and Escalada 1997) [1, 2, 3, 4, 5, 6, 7]. The indiscriminate use of synthetic chemical pesticides for the management of these pests led to disturbances in natural ecosystem, leading to resurgence of pests, toxic hazards and residues besides environmental problems. This dictated the need to look for other available alternatives and their use in an integrated manner. IPM is a pest management system that in the context of the associated environment and the population dynamics of the pest species, utilizes all suitable techniques and methods in as complete manner as possible and maintains the pest population at a level below those causing economic injury (Hoeng and Escalada 1997, Hoeng and Ho, 1987, Bjornsen 2003 and Brosius *et. Al.*, 1986) [5, 6, 7, 8, 9]. FAO defined IPM means the careful consideration of all available pest control techniques and subsequent integration of appropriate measure that discourage the development of pest population and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. The IPM programmes in rice gained momentum is inadequate in the Purvanchal Region of Uttar Pradesh. IPM programmes in the state is an attempt to promote ecological, economic and sociological outcomes which is accomplished by the best mix of control tactics by State Agriculture Department and State Agricultural Universities. The farmers were provided training on IPM and were made aware of beneficial insects and side-effects of indiscriminate use of pesticides. The IPM module was developed, validated and promoted with the use of appropriate scouting tactics, proper identification and diagnosis of pests and diseases, the use of action economic thresholds and conservation of naturally occurring biocontrol agents. (Fajardo *et al.*, 2000, Goodwell *et al.*, 1982 and Kenmore *et al.*, 1985) [10, 12, 11].

However, the study on the knowledge perception, adoption and constraints in IPM of important crop like rice has not been undertaken. The study on perception and adoption of the IPM and constraints impeding such options will facilitate in planning the future strategy.

Materials and Methods

The experiment was conducted by the Department of Agricultural Entomology, U.P. College

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EFFECT OF HERBAL SUPPLEMENTATION OF LIV.52 LIQUID ON THE PERFORMANCE OF COCKEREL CHICKS

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Abstract: A study was undertaken to observe the effect of herbal supplementation of Liv.52 liquid on the performance of cockerel chicks. Day old 100 local cockerel chicks were procured and randomly allotted which were divided randomly into four groups. Cockerel starter and finisher ration was given with supplementation of Liv.52 having groups: G1 (control)- Commercial ration without supplementation of Liv.52, G2- commercial ration+Liv.52 @ 0.75ml in drinking water per day, G3- commercial ration+Liv.52 @ 1.25 ml in drinking water per day and G4- commercial ration+Liv.52 @ 1.75 ml in drinking water per day from 0-6 weeks of experimental study. The data were regularly recorded for weekly body weight gain, total feed intake, total water intake, mortality and feed conversion ratio was calculated. Statistical analysis of result revealed that Liv.52 liquid supplementation were significantly ($P<0.05$) improved body weight gain and zero mortality in supplemented chicks. Feed intake and water intake were found non-significant ($P>0.05$). It may be concluded that G4- (1.75 ml Liv.52 in drinking water per day+ commercial ration) was found to be best compared to other groups. Herbal supplementation of Liv.52 liquid in cockerel diets is beneficial.

Keywords: Cockerel chicks, Cockerel diets, Liv.52 liquid, Herbal supplementation, Commercial ration.

Introduction: Poultry is the fastest growing agricultural sub-sector, especially in developing countries. The global poultry sector is expected to continue to grow as demand for meat and eggs is driven by growing populations, rising incomes and urbanization. Particularly for small holders and the poor, both in rural and urban areas, poultry is a major asset and key to poverty alleviation, providing income and market participation. Cockerel is a young rooster, a male chicken which has not been castrated, when a chicken transition from being a cockerel to a rooster is a bit ambiguous, but in general, a rooster is a chicken which has fully matured and mated with hens, while a cockerel is either still growing, or inexperienced with hens. When a cockerel is castrated, it becomes a capon. Capons do not develop in the same way as un-castrated birds, and they tend to be calmer and easier to handle as well as physically different from roosters and cockerels. Poultry meat mainly comes from two sources: Broilers and Cockerels. The small poultry farmer prefers to rear cockerel

than broiler because of low cost and lesser susceptibility to disease compared to broiler production. Cockerels are raised in both urban and rural areas. Cockerel is a male chicken under one year of age. Some of the reasons for rejecting the cockerels on commercial quantity are:

1. Slow growth rate.
2. Low feed conversion rate.
3. Non tender meat at maturity.

Even with above reasons, there are still advantageous features of the cockerels over broilers such as:

1. Cockerels are strong and therefore easier to rise.
2. Meat from cockerels possesses better taste due to their age at maturity.
3. Cockerels can easily be raised on free range system.
4. Cost of chicks is very low which enhances more profit.

Cockerels have several traits which distinguish them from hens, often at a very early age. When

Original Research Article

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Correlations among Flowering, Pollen Viability and Malformed Panicle in Mango (*Mangifera indica* L.) Cultivars

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ABSTRACT

The present investigation was carried out during 2010-12 to establish the correlation among flowering, pollen viability and malformation in 15 mango cultivars namely Amrapali, Bhadauran, Dushehari, Erwin, Husnara, Janardan Pasand, Langra, Mallika, Neelum, Primor de Amoreira, Pusa Arunima, Sensation, Tommy Atkins, Totapuri Red Small and Zill at the Division of Fruits and Horticultural Technology, Indian Agricultural Research Institute, New Delhi. The flowering duration had significant positive correlation with days required for 50% bloom, per cent hermaphrodite flowers and had significant negative correlation with *in vitro* germination of fresh pollen. Per cent hermaphrodite flowers had negative correlation with total flowers and pollen viability. Total number of flowers showed significant positive correlation with per cent male flowers but negative correlation with hermaphrodite flowers percentage. The malformed panicle had positive correlation with day required for 50% bloom and had negative correlation with panicle length. Thus, on the basis of results it can be concluded that correlations among flowering, pollen viability, and malformed panicles are pre-requisite for any of the breeding programme. Direct selection may be followed for the improvement of mango for these characters.

Keywords

Flowering, correlations, Pollen viability and malformation

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Introduction

Mango is one of the commercially important fruit crops of tropical and sub-tropical worlds. At present more than 100 countries produce mangoes and still remains a prominent horticultural crop of India. The fruit occupies

an important socio-economic position in India and south-east Asian countries where it is held in high esteem. India produces 22.40 million tonnes mango from 2.23 million hectare area (NHB, 2018-19). In India, there are hundreds of mango cultivars, of which only about 20-25 cultivars are being grown commercially

Influence of Jeevamrut, Vermicompost and FYM on the growth and yield of chilli (*Capsicum annum L.*)” Var. Kashi Anmol

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ABSTRACT

A field experiment was conducted to study the “Influence of Jeevamrut, Vermicompost and FYM on growth and yield of chilli (*Capsicum annum L.* Var. Kashi Anmol) in Department of Horticulture Udai Pratap Autonomous college Varanasi during rabi season 2019-2020. The experiment was laid out in RBD with three organic sources and their combinations. The Influence of various organic sources on growth and yield parameter in chilli with different nine treatment of Jeevamrut, Vermicompost and FYM were applied. The application of 100% NPK through vermicompost @5t/h + Foliar Spray of Jeevamrut 6%, i.e. T₇ gives the better result for Plant height (cm), number of fruit /plant, length of fruits (cm), weight of fruits/plant (kg), fruit yield (q/ha). While, the treatment T₈ (Jeevamrut @ 6 %) give the better response to stem girth (cm), day of 50% flowering (from date of sowing). Hence, the result was found were satisfactory to treat the chilli plant with integration of Jeevamrut, FYM and vermicompost than solely.

Keyword- Jeevamrut, Vermicompost, FYM, Chilli, Growth and yield.

Introduction

Chilles are the good source of natural bactericidal agents to be used in food and medicinal system. It is commercially important vegetable crop for two qualities i.e, red color which is due to the pigment capsanthin and its biting pungency which is due to capsaicin. According to Hornero –Mendez *et al.*, (2002), Chilli is highly heterogeneous plant which show considerable morphological variation, especially in fruit, shape, size and color. It produces bisexual flower which are borne at the intersection between the stem and leaves at points where the stem split into a fork. The inflorescence may vary from solitary to seven flower at one node. It includes more than 30 species which show more variability

for quality traits and yield, like fruit shape and fruit weight. It has five general species i.e. *C. annum*, *C. baccatum*, *C. frutescens*, *C. pubescens*, *C. chinense*. Out of them is *C. annum* widely cultivated species which includes both hot pepper and sweet paper (wang and Bosland, 2006). The length of the style and relative position of the anthers and stigma change into genotypes and it is the important factors that allocate level of natural cross-pollinations of the flower. The color, shape, length and relative position of the styles also vary with different species and cultivars.

Kashi Anmol is the selection from base population (KA-2) introduced from Sri Lanka. It has determinate dwarf umbrella shape plant type. The fruit size is medium long, straight and smooth having

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Evaluation of the Nutritional Quality and Health Benefits of Chickpea (*Cicer arietinum* L.) by using New Technology in Agriculture (Near Infra-red spectroscopy-2500)

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ABSTRACT

Background: Among the pulse crop world chick pea known as important pulse crop which is grown and utilized in the world. This crop nutritionally rich in the carbohydrates, protein which has superior quality protein than the other pulse crop. This pea consists of lots of essential amino acids except the sulphur containing amino acids. So that it is a good combination of diet with the cereals. In the plants mostly carbohydrates stored in the starch form but also followed by oligosaccharides and reducing and non-reducing sugars. In this crop lots of nutritionally rich substances but it has low amount of fats and large amount of unsaturated fatty acid which is very beneficial to the heart patient. The minerals which are present in chick pea are Calcium, magnesium, phosphorus and especially potassium. The vitamins which are present in this pulse such as riboflavin, niacin, thiamin, folate and the vitamin A precursor, β -carotene. The pulses also have anti-nutritional factors which can be minimized by the using of lots of cooking methods.

Methods: Through NIRS-2500 evaluated twenty samples of chick pea. It is an instrument through which Near Infrared (NIR) analysis a spectroscopic technique that makes use of the naturally occurring electromagnetic spectrum. This works in the region of the spectrum defined by wavelengths between 700nm and 2500nm. All the cultivars were found to cluster in major four groups on the basis of principal component analysis. The result showed the diversity between nutritional and antinutritional factors in the cultivars that could be further used by plant breeders to develop superior genotypes. The chick pea has lots of advantages which cure the several diseases such as cardiovascular disease, type 2 diabetes, digestive diseases and some cancers.

Result: Here we study twenty samples of chick pea in which the biochemical composition of this crop consists of protein was varied from 22.12% to 24.42%, sulphur containing amino acids ranged from 0.15 to 1.25% and Tryptophan was ranged from 0.63 to 1.38% which was analyzed by NIRS-2500.

Key words: Anti-nutritional factors, Diet, Digestibility, Essential amino acids, Nutrition.

INTRODUCTION

In the human beings proteins are required for the building of the tissue in the growing human child. Commonly it is known as poor man's meat or in the rich people it is known as rich man vegetables. Now a day India become independent in the area of pulse production, productivity and consumption and also import. India occupies approximately 29% world area and 19% pulse production on the world bases. So that India looks a large producer, consumer of this crop. Mostly India also becomes a large importer and processor in the pulse field. In the pulse production data it varies from 14-15 MT to become 22-23 M ha. since 1990-91 (Aguilera, 2009). In the state wise pulse production varies from Madhya Pradesh (20.3%), Maharashtra (13.8%), Rajasthan (16.4), Uttar Pradesh (9.5%), Karnataka (9.3%) Andhra Pradesh (7.9%), Chhattisgarh (3.8%), Bihar (2.6%) and Tamil Nadu 2.9%). Pulse productivity which was 923 kg/ha in 2019-20. Chickpea (*Cicer arietinum* L.), commonly known as garbanzo bean, Bengal gram, it is found in old world pulse and among the seven Neolithic founder crops which is in the fertile crescent of the near east. Now a days this crop can be grown around fifty countries which was acrossed Indian subcontinent, North Africa, Middle East, southern Europe (Alessio, 2011).

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Global scenario of chick pea

On the basis of globally point of view this pulse crop possess third position in the area of production followed by dry beans, field pea. In India production of pulses was minimized and varied from 14-18 MT. However, from 2016-17, the production crossed 23 MT. In 2016-17, the production of pulses was 23.13 MT, in 2017-18, it was 25.42 MT and in 2018-19 is around 23.22 MT. (Bernable, 1993)

The country which produces chick pea such as includes Pakistan, Turkey, Australia, Myanmar, Ethiopia, Iran, Mexico,



Effect of Different Level of Nitrogen and Boron on Growth Performance and Yield of Radish cv. Kashi Hans

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Abstract

The experiment was laid out in RBD having 12 treatment and 3 replications. Application of different levels of Nitrogen and Boron have marked effect on Growth and yield of Radish on the different stage. All the growth character such as Height of plant, Number of leaves of plant, Length of leaves and length of root are increased with the increase in nitrogen. Boron shows positive response to the quality characters such as Percent dry matter and Ascorbic acid, on interaction with Nitrogen it showed significant response in all aspect of Growth and Yield. The best results regarding various growth character was found in T₉- 60 kg N, 0kg B, but somehow highest root yield was obtained under T₁₁ under the combination- 60 kg N and 10 Kg B. Boron have huge impact on quality of Radish as it shows with the results, best quality were obtained with the application of T₁₁- 60 Kg N And 10 Kg B. An effort was made to estimate the cost of cultivation and cost benefit Ratio with use of each treatment separately and on the basis of result the highest net Profit was obtained with the Treatment T₉ followed by T₁₀. Highest B.C.R. was also recorded with the Treatment T₉. On the basis of above finding it can be concluded that best treatment was T₉, with comparatively low input and high yield favours the use of treatment, followed by T₁₁, which is high performer in all aspect of growth and yield but more costly on comparison with second best T₉.

Key words : Radish, growth, yield, nitrogen and boron.

Introduction

Radish (*Raphanus sativus* L.) is a diploid species, Radish (*Raphanus sativus* L.) is a diploid species and is popular in both tropical and temperate region and can be grown through out the year. Radish is one of the most ancient crops as the inscription on inner wall of pyramid shows that radish was used in Egypt about 2000 B.C., some source also reveal that it was cultivated in about 2700 B.C. it is well known root vegetable native from Europe or Asia. Asiatic radish is originated from *Raphanus sativus* f. Raphnistroids and originated from Mediterranean region. It belongs to *Brassicaceae* family and grown throughout in the country for its young fleshy roots mainly.

When we talk about nutrients healthy plants often contain 3-4% nitrogen in tissues, this is higher in comparison to other nutrients. It is essential constitute of protein, nucleic acid, chlorophyll and enzymes etc. when nitrogen is deficit in soil, the harvest is poor in size and quality (Hussain *et al.* 1997). Both low and high application of nitrogen results in loss of production and quality of crop. Nitrogen is related to both production and quality and boron is essential for quality and deficiency of boron can increase the production of thiocyanates, which are known giotrogens. Nitrogen is a paramount nutrient for plant since it is a core component of many plant structures and for both their internal and external metabolic.

Boron is essential for normal growth and production of sound, healthy vegetables. Boron is required for pollen tube development, pollen germination, plasma membrane stimulation, floret fertility, anther development, and seed formation. Boron shortage causes a decrease in leaf photosynthetic rate, plant height, the quantity of reproductive structures during the squaring and fruiting stages, and dry matter production (Wang *et al.* 2003). As we can see both nutrients are essential for quality and quantity of production, it is very important for farmer to know right level of nutrient which is essential for good production of radish. Keeping the above point in mind the present investigation “Effect of different levels of nitrogen and Boron on growth performance and yield of Radish (*Raphanus sativus* L.) cv. Kashi Hans”

Materials and Methods

The present investigation “Effect of Nitrogen and Boron on growth performance and yield of Radish cv. Kashi Hans” was Carried out in 2020-21 at research form, Department of Horticulture, Udai Pratap (Autonomous) College, varanasi. The topography of field was uniform with gentle slope and adequate drainage. The experiment was laid out in RBD having 12 treatment and 3 replications. Observation were recorded at five tagged plants from each treatment and each replication for growth, yield and quality. Growth, yield and quality parameters of the following traits were recorded *viz.* Plant height(cm), Number of leaves, length of leaves(cm), length of

PCV, GCV, Heritability (Broad Sense) and Genetic Advance Present in Tomato Germplasm With Respect to Yield and its Components Characters

Pratikshit Singh, Shashi Bala, S.B.Verma

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ABSTRACT

Tomato (*Solanum lycopersicum* L. = *Lycopersicon lycopersicum* L. earlier known as *Lycopersicon esculentum* Miller) is an important vegetable crop in India. The present study involved evaluation of 153 genotypes of tomato germplasm collections. The experiment was conducted in Randomized Block Design with three replications at experimental farm of Indian Institute of Vegetable Research, Adalpur, Varanasi. The data obtained on various characters were analysed for analysis of variance, mean performance of genotypes, coefficient of variability, heritability (broad sense), genetic advance and correlation coefficients. Analysis of variance for the design of experiments indicated highly significant differences among treatments for all characters. The entry CLN-1621, C-5-2, DMT- 1, C-10-1 and C-13-1 produced highest yield per plant. These lines also possessed average to high mean performance for most of the yield components. In general, phenotypic coefficient of variability (PCV)

was higher than genotypic coefficients of variability (GCV) for all the characters. The highest phenotypic and genotypic coefficient of variability was observed for fruit weight, plant height, fruit width and number of fruit per plant, whereas days to first fruit setting, days to 50 % fruit setting and days to 50 % flowering showed moderate values. High estimates of heritability (85%) were observed for all traits. The high magnitude of heritability in broad sense coupled with genetic advance in percent of mean were observed for yield per plant, fruit weight, number of fruit per plant, number of branches per plant, locules, days to 50 % fruit setting, first fruit setting and days to 50 % flowering. A very strong and positive association of yield per plant was observed with days to 50% flowering, days to 50% fruit setting, days to first fruit setting, plant height, number of branches per plant, number of fruit per plant, fruit weight, fruit length, fruit width, locules, total soluble solid and yield per plant. However, number of branches per plant showed strong association with yield per plant in negative direction.

Keywords Tomato (*Solanum lycopersicum*), PCV, GCV, Genotypes, Heritability.

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INTRODUCTION

Tomato (*Solanum lycopersicum* L., $2n=2x=24$) is a very versatile vegetable for culinary purposes. Ripe fresh tomato fruit is consumed as salads and after



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Association of Personal And Socio-Economic Characteristics of Trained And Untrained Respondents With Their Knowledge And Adoption of Paddy Cultivation

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Abstract

This research highlights the impact of training programme of Krishi Vigyan Kendra on selected farmers of district Sultanpur, Uttar Pradesh. It reveals that the majority of 48.75 per cent trained respondents who had high economic status, whereas the majority of 61.25 per cent untrained respondents had medium economic status. The result indicates that The majority of trained and untrained 61.25 per cent respondents had medium social status and majority of 51.25 per cent respondents were of middle age category. The majority of 50 per cent trained respondents adopted three crops in a year and the majority of 50 per cent untrained respondents had adopted two crops in a year. The significant difference in knowledge on preliminary preparation, manures/fertilizers and overall knowledge about paddy cultivation between the trained respondents, who had education upto Junior High School and Intermediate & above. The significant difference about adoption of all the practices as well as overall improved practices of paddy cultivation was found among all the categories of personal and socio-economic variables – age, caste, education, social status, economic status, socio-economic status of trained respondents with each other due to inconsist behaviour of the respondents.

keywords: Paddy cultivation, knowledge, adoption, trained and untrained respondents, Krishi vigyan kendra, training programme, technology.

Introduction

Paddy is the staple food for Indian population. This crop plays an important role in the national economy of the country, but many paddy cultivating farmers live under the poverty line. Most resource-poor farmers are forced to use their limited resources to produce adequate food for their family, leading to the degradation and reduction in potential of these resources (Dat Van Tran). To achieve national food security, high yielding varieties have been produced to increase paddy production to reach self-sufficiency. India is the second largest producer of rice in the world after China, with a share as large as about 22 per cent of the world's rice production. It is one of the important cereal crops of the world and



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General Profile of The Trained And Untrained Respondents of K.V. K. About Paddy Cultivation

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Abstract

This study was conducted to find out the general profile of trained and untrained respondents of KV K about paddy cultivation. The locale of the present study KVK Sultanpur (U.P.) was selected purposively. The total sample size was 160. The selection of respondents was made based on proportionate random sampling procedure. The list of trained and untrained respondents of each selected villages were obtained and prepared. The majority of 48.75 per cent trained respondents who had high economic status, whereas, the majority of 61.25 per cent untrained respondents had medium economic status. The majority of 50 per cent trained respondents adopted three crops in a year and the majority of 50 per cent untrained respondents had adopted two crops in a year of cropping pattern. The source of irrigation among majority of 68.75 per cent trained respondents had tubewells followed by canal and pumping sets, in case of untrained respondents 52.20 per cent had pumping sets followed by canal and tube wells.

Keywords: Trained and untrained respondents, socio-economic status, acceptance, adoption, technical know how, Knowledge, Economic Status, low, medium and high.

Introduction

Agriculture is the backbone of Indian economy. This sector provides livelihood to about 65 to 70 per cent of the labor force. Training is a planned communication process caused development to bringing desirable changes in behavior. Training of farmers has been considered as a critical input for accelerating agriculture production and transfer of technical know-how from the core of the process of agricultural development. Vocational training is one of the most important functions of new mandate of the integrated model of KVK. The main purpose of organizing training programme is to provide new knowledge and develop new skills required for adoption of the latest technology and build up desirable scientific attitudes among farmers, farm women, rural youths, school drop-outs and grass root level extension functionaries. Training programmes are to be organized in the field of crop production, livestock production, horticulture, fisheries, agricultural engineering, home science and a number of other related vocations. To make training of farmers more effective and easier at grass root level, ICAR established a wide network of Krishi Vigyan Kendras in all over country. The first KVK was established in 1974 at Pondicherry under the supervision of the Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu).

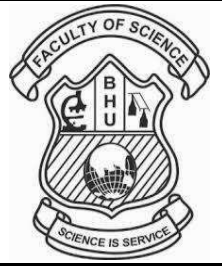
Ethical Aspects in Advertising: Indian Perspective**Dr. Rajeev Krishna Singh**
Arif SultanAssociate Professor, Department of Commerce, Udai Pratap College, Varanasi
Research Scholar, Department of Commerce, Udai Pratap College, Varanasi**ABSTRACT**

Advertising is the paid, persuasive, impersonal form of marketing communication from an identified sponsor disseminated through channels of mass communication to promote the adoption of goods, services or ideas. In today's changing market economy, advertising play a powerful and constructive role for any company to compete and survive. On the contrary, they also play a negative role in hurting the sentiments of an individual or the society. Hence, it is important that advertising professionals observe high ethical standards with regard to truthfulness, human dignity and social responsibilities. Advertising, using media as its vehicle, is a powerful force shaping attitudes and behavior in modern society. At times it goes beyond the traditional role of 'fair and truthful' information and portrays obscene, undesirable and unethical scenes giving a detrimental result especially on the young population of the society. Keeping this in view, this paper attempts to focuses on ethical conflicts in advertising arising out of exaggerated claims, false promises, stereotyping, puffery, surrogate advertising, misinforming the buyers and other forms of unethical advertising, thus breaches the laws of ethics and ethical code.

Keywords: Advertising, Ethics, Advertising Ethics, Misleading claims, Unethical advertising

INTRODUCTION

Advertising is a form of communication used to persuade target audience (viewers, readers or listeners) to take some action with respect to products, ideas, or services. Advertising messages are usually paid by sponsors and viewed via various traditional media, including mass media such as newspaper, magazines, television commercial, radio advertisement, outdoor advertising or direct mail, or new forms of interactive media such as websites, e-mail messages, through mobile applications and text messages. In our day to day lives, we always face situations where we have to take decisions, and decide what is right and wrong. We are always faced with the debate of what is moral or immoral, ethical or unethical and according to the perception of each individual, the right decision from their point of view is made. The proper definition of "Morals"; are the beliefs that people hold against what is considered right or wrong. Morals direct people as they make decisions in their personal and professional lives. Another term that always accompanies Morals is Ethics; these are the principles that serve as guidelines for both individuals and organizations, they help create boundaries regarding what is acceptable and what is not, since these behaviors are related to moral feelings about right and wrong. (Clow&Baack,2007) Over the years advertising and marketing communication messages have created a lot of debatable ethical issues, due to the public belief , that advertisements nowadays deeply affect the way people perceive themselves and the world surrounding them, including crucial actions and behaviors.(Foley1999). For these reasons, Moral issues in marketing are important, given the fact that marketing is expected to identify, predict and satisfy customer requirements profitably (Carrigan et al, 2005). Due to the difficult equation between both ends of the marketer's responsibility, some actions (like certain Ads), have led to the creation of new laws and regulations regarding the world of advertising. (Clow&Baack,2007). In order to have a better understanding of the situation, we need to further explore the world of advertisements, the appeals used, the targeted decision making components and the effects of Ads on the targeted consumer as a whole. There are two main components advertisers aim to effect; the affective component, where affective message strategies are applied by invoking feelings and trying to match them with the product or service offered in an effort to increase the likeability of the product, and also the cognitive components, where the Ad focuses on the attributes and benefits of the product, encouraging the consumer to buy it (Clow & Baack, 2007). Such components are affected by the leverage points in an Ad; these



Tapping the Sentiment of the Customers through Association Rule Mining for the Products Endorsed by Celebrities

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Abstract: The impact of customers sentiment in the current era is unmatched. Not only celebrities but the customers too are influencers in the revenue growth of a brand. Efficient Marketing analytics in terms of sentiment analysis is required for which association rule mining could be utilized as a prominent model. The current work explored the Predictive Apriori Algorithm to understand the sentiment of the Varanasi customers. The algorithm has performed with an accuracy of 99.34 % which proved that they stop purchasing the products once the celebrity has had negative publicity or is involved in anti-national activities. The work has also explored the correlation between the questions being asked in the survey and found that they strongly agree that the brand is effective if it is endorsed by several celebrities over a while.

Index Terms: Predictive Apriori; Sentiment Analysis; Celebrity Brand Endorsement; Association Rule Mining; Marketing Analytics; SMAC

I. INTRODUCTION

The impact of customers on the revenue of the key industry players are huge and thus the sentiment of the customers is found to be the foundation stone to the success of any product in terms of revenue. Public sentiment is also one of the core factors to decide a brand's popularity. Thus, not only celebrities but also the public has become a great influencer on the success of brands and consequently became a part of the marketing strategy. Now the customers are not blindly following the celebrity's footsteps but also raising their voices against them. This calls for efficient mining of the customer's sentiment. Database mining in the retail industry in the era of Social Mobility Analytics and Cloud (SMAC) (Kumar et al., 2016a, 2016b; MK Pandey, 2017; Pandey et al., 2013; Pandey & Subbiah, 2016, 2018, 2017) & Big Data is found to be a crucial factor in the improvement of marketing strategy (Agrawal et al., 1993; Zaki, 1999). Association rule mining works by finding closed association among the set of data items through correlation study. The identification of these associations helps

the companies in making improvised decision making. One such example of association rule mining used in the Fast-Moving Consumer Goods (FMCG) sector is market basket analysis where consumer purchase habit is analyzed and an association is being established between the items purchased. The current work for the first time has utilized the benefits of Association Rule Mining to tap the customer's sentiment for the products endorsed by celebrities. The problem can be represented mathematically as,

Given the database D consisting of questions asked from the customers from Q_1 through Q_N . The problem is to identify n rules $R_1 \dots R_n \in \{[x \Rightarrow y] | x, y \subseteq \{Q_1, \dots, Q_N\}; y \neq \emptyset; x \cap y = \emptyset\}$ that results in the maximum predictive accuracy $acc([x \Rightarrow y])$ (Tobias Scheffer, 2001). The predictive accuracy acc is represented as the probability of the predicting correct rule for new data.

The current work is distributed into six sections. The first section introduces the importance of sentiment analysis and association rule mining. The second section briefly describes the dataset and the methodology used. The third section discusses the metrics incorporated for the performance evaluation. The fourth section describes the result and discussion followed by the conclusion in the fifth section. In the end, references are given.

II. DATASET AND METHODOLOGY

A survey is conducted in Varanasi in 5 different locations namely, Lanka, Chauk, Shivpur, Pandeypur and Sagra. In the survey, the following questions were asked to see the sentiment of the customers during purchase made for the products endorsed by celebrities. The options given to them was whether they strongly disagree, disagree, neutral, agree or strongly agree to these questions. The responses again were mapped to numeric ratings as 1,2,3,4 and 5 for strongly disagree, disagree, neutral, agree or strongly agree respectively. A total of 250 samples were



A comparative study of Capital Productivity in Agriculture: Interstate Analysis

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ABSTRACT

As a source of livelihood, agriculture and allied activities remain the largest sector of Indian Economy till now. The growth of this sector has rapidly goes down and the share of this sector to GDP is also declining which was 29.53% in 1990-91 to 10.32% in 2016-17. The share of plan outlay was 14.9% in first plan which was decline to 3.70% in eleventh plan. Here researcher is taken capital in term of public investment and then compare the capital productivity & its intensity among some states. This study is based on secondary data and tested by F statistics. Many factors account for the difference in public investment in different state i.e. resources of the state Government, grants from the Central Government, fertility of soil, prospects of further agricultural growth and political considerations are some of the factors responsible for difference in level of public investment per hectare in different states. For example, political considerations have prompted the Central Government to announce special economic assistance of Jammu and Kashmir, during every phase of study. Sufficient resources of the state government and fertility of soil and the future prospects of agricultural growth account for a high level of public investment in the state of Punjab. All Analysis shows that there is a regional disparity in public expenditure, therefore sectorial GSDP in agriculture is also differing. Intensity of public investment and Capital Productivity show that no any states which use constant Intensity of public investment and Capital Productivity during this period. It is also clear that no any trend in both i.e. Intensity of public investment and Capital Productivity and its range is very high too. Therefore no any certainty to find fixes output by unexpected public expenditure. At last it can said that investment on agriculture and allied sector has less impact on sectorial GSDP or it can be said that these investment is actually just like an expenditure that are spending on agriculture and allied activity which doesn't improve any productivity of the agriculture sector.

Keywords: *GSDP, Public Investment, Capital Productivity and Intensity of public investment.*

1. INTRODUCTION

As a source of livelihood, agriculture and allied activities remain the largest sector of Indian Economy till today. It is also known as the form of Indian culture. Therefore, government pay attention on this sector seriously and try to get rid of the obstacles that are responsible for declining the growth of his sector. The growth of this sector rapidly goes down and the share of this sector in GDP is also declining. it was 29.53% in 1990-91 that would decline 10.32% in 2016-17. Growth of this sector is 3.60 in first plan while it was

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Big-Five Personality Traits, Self-Compassion and Mental Health among University Students

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Abstract

The occurrence and severity of mental health issues among university students is increasing globally. India is also on the same platform when it comes to alarming mental health issues among students. However, most studies so far have been limited to assessing the prevalence and outcomes of psychological issues, and a paucity of studies investigating the protective factors for students' mental health was observed. With the advent of the salutogenic approach, the research interest in health-protective factors, as opposed to risk factors, has heightened drastically. Given this, the present work investigated the role of personality traits and self-compassion in university students' mental health. A correlational research design was employed. Participants included university students assessed on Costa & McCrae's (1992) NEO-Five Factor Inventory, Self-Compassion Scale (Neff, 2003), and Mental Health Inventory (Jagadish & Srivastava, 1983). Data analysis employed Pearson's correlation and multiple linear regression analysis. Extraversion, agreeableness, and self-compassion were positively associated with mental health, whereas neuroticism was negatively associated. The OCEAN personality traits and self-compassion explained significant variance in mental health, and only extraversion positively and significantly predicted mental health. OCEAN Personality Trait Extraversion is a protective factor for university students' mental health.

Keywords: Personality, Self-compassion, Mental Health, University Students

Introduction

Within the past few decades, higher education has become increasingly competitive. Academic stressors such as institutional and familial expectations, maintaining study hours, meeting tuition costs, adjusting to new surroundings, etc. contribute to mental health issues such as stress, anxiety, depression, etc. among university students (Fawzy & Hamed, 2017; Ratanasiripong et al., 2018), and around 57% of them become liable to psychological problems (Üner et al., 2008). Psychological disorders have a significant percentage of the global burden of diseases and a

substantial burden on the global economy. In most cases, they translate into self-harming behaviours, including suicide, which is a major public health issue everywhere (CDC, 2010), including India (Seby et al., 2011).

Personality is a psychological variant that affects individuals' personal and societal behaviour (Mahmod Aliloo et al., 2010) and significantly affects mental health. However, prior studies (Baghiani-Moghaddam et al., 2012; Löckenhoff et al., 2008) examining the association have yielded mixed findings. With the

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Variance Estimator for Two Variate Ratio Estimator Under Unequal Probability Sampling

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Abstract

This paper suggests variance estimator for unbiased ratio estimator \hat{Y}_{RT} consisting variates X_1 and X_2 under unequal probability sampling. The non-negativity conditions for these estimator are also obtained.

1. Introduction :

For a finite population $U_1 U_2 \dots U_N$, let Y_i & X_i are values of study variate Y and auxiliary variate X for i^{th} unit of population ; $i=1, 2, \dots, N$. The ratio estimator is unbiased under probability proportional to aggregate size (PPAS) scheme due to Hajek (1949), Lahiri (1951) and Midzuno (1952). Extending the ideas contained in Lahiri(1951), a two variate ratio estimator \hat{Y}_{RT} , was proposed by Kumar (2021) using probability proportional to aggregate size (PPAS),

$$\text{where } \hat{Y}_{RT} = \frac{Y_s}{(w_1 \bar{X}_{1s} \bar{X}_2 + w_2 \bar{X}_{2s} \bar{X}_1)} \cdot X_1 X_2 \quad (1.1)$$

$$\text{where } Y_s = \sum_{i \in s} Y_i, \quad X_{1s} = \sum_{i \in s} X_{1i} \quad \& \quad X_{2s} = \sum_{i \in s} X_{2i} \quad (1.2)$$

Also variance

$$\text{Var} \left[\hat{Y}_{RT} \right] = \sum_{i=1}^N \alpha_{ii} Y_i^2 + 2 \sum_{i < j} \alpha_{ij} Y_i Y_j \quad (1.3)$$

$$\text{where } \alpha_{ii} = \frac{X_1 X_2}{M_1} \cdot \frac{1}{(w_1 \bar{X}_{1s} \bar{X}_2 + w_2 \bar{X}_{2s} \bar{X}_1)} - 1 \quad (1.4)$$

$$\text{and } \alpha_{ij} = \frac{\bar{X}_1 \bar{X}_2}{M_1} \cdot \frac{1}{(w_1 \bar{X}_{1s} \bar{X}_2 + w_2 \bar{X}_{2s} \bar{X}_1)} - 1$$

2. Proposed Variance estimator :

Following Vijayan (1975) and Rao (1979), it can be seen that the estimator \hat{Y}_{RT} is unbiased and linear and $\text{Var} \left(\hat{Y}_{RT} \right) = 0$ where that ratios $\frac{Y_i}{w_1 x_{1i} \bar{X}_2 + w_2 x_{2i} \bar{X}_1}$ are all equal.

Using theorem 1 of Rao (1979) and putting $d_{ij} = \alpha_{ij}$ and $w_i = (w_1 x_{1i} \bar{X}_2 + w_2 x_{2i} \bar{X}_1)$ in general form of non-negative unbiased variance estimators of Rao (1979), we arrived at the following class of non-negative unbiased variance estimators, for sample s ,

$$v_s = \hat{V}ar \left(\hat{Y}_{RT} \right)$$



TRANSMUTED INVERSE LOMAX DISTRIBUTION AND ITS PROPERTIES

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Abstract: The objective of the paper is to initiate a new extension of inverse Lomax distribution represented by transmuted inverse Lomax distribution (TILD). The quadratic rank transmutation map (QRTM) method has been used to generate this probability distribution by inserting new parameter that would lead more flexibility. Different statistical properties like moments, inverse moments, moment generating function, quantile function, order statistics *etc.* have been discussed. Maximum likelihood method of estimation has been discussed and used to estimate the unknown parameter of the proposed model. A real data set has also been carried out to know the usefulness of the model in real life scenario and compared with some chosen distributions on the basis of some chosen model selection criterions.

Key words: Inverse lomax distribution (ILD), Quadratic rank transmutation map (QRTM), Survival function.

Cite this article

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PCM Transformation: Properties and Their Estimation

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Abstract

In the present piece of work, we are going to propose a new trigonometry based transformation called *PCM* transformation. We have been obtained its various statistical properties such as survival function, hazard rate function, reverse-hazard rate function, moment generating function, median, stochastic ordering etc. Maximum Likelihood Estimator (MLE) method under classical approach and Bayesian approaches are tackled to obtain the estimate of unknown parameter. A real dataset has been applied to check its fitness on the basis of fitting criterions Akaike Information criterion (AIC), Bayesian Information criterion (BIC), log-likelihood (-LL) and Kolmogorov-Smirnov (KS) test statistic values in real sense. A simulation study is also being conducted to assess the estimator's long-term attitude and compared over some chosen distributions.

Keywords: Maximum likelihood estimator, moment generating function, $PCM_E(\theta)$ -distribution, absolute relative bias (ARB), simulation study.

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Genetic divergence and cluster analysis in garlic (*Allium sativum* L.) using D² statistics

Gaurav Singh, CN Ram, Mayank Singh, Angad Singh and Arun Singh

Abstract

The experiment on sixty genotypes including four check varieties (G-50, G-41, G-282 and Punjab Garlic) of garlic (*Allium sativum* L.) was conducted to work out the genetic divergence, and cluster analyses of their various attributes on yield per plant. The maximum bulb yield per plant was observed in NDG-26 (29.97 g) followed by NDG-41 (29.30 g) and NDG-5 (28.22 g) against the general mean 23.40 g. While the minimum bulb yield per plant was recorded in NDG-31 (15.13 g). In the present study, genotypes are divided into eight clusters. Cluster I had maximum number of genotypes followed by clusters II, cluster V, cluster VIII, cluster III, cluster IV, cluster VII and cluster VI. The maximum intra-cluster D² value observed in cluster IV. The maximum inter-cluster distance was observed between cluster VII and cluster VIII. The cluster I showed highest mean for number of cloves per bulb and cluster IV showed highest mean for weight of clove. A per cent contribution showed that plant height was found for highest contribution followed by length of leaf, number of cloves per bulb and total soluble solids for total divergence among the available genotypes of garlic.

Keywords: Garlic (*Allium sativum* L.), genetic diversity (D²), cluster and bulb yield

Introduction

Garlic (*Allium sativum* L.) is classified under the class monocotyledone 2n=2x=16, and belongs to the section Porrum of the family Alliaceae. It is known as *Lahsun* in Hindi, is the second important bulb crop after onion grown in India. It is also important foreign exchange earner and used as spices & condiments. Garlic is rich in protein, phosphorus, potassium, calcium and carbohydrates and also considered as "Nectar of Life" in Ayurveda. A compound bulb contains the edible product of this crop. Garlic is used all over the world for flavouring, different kinds of food materials and as condiments, notable in chutneys, pickles, curry powders, curried vegetables, meat preparation, tomato ketchup in medieval Europe, it is widely used for distinguishing the smell and flavour of salted meat, fish in the Philippines, much of Eastern Asia and other parts of tropics. The dehydrated garlic in powdered or granulated form is replacing the fresh bulbs for industrial and home use in many countries. Central Asia is the primary centre of origin of garlic followed by Mediterranean region (Thompson and Kelly, 1957). Garlic is cultivated from long ancient times. Its wild ancestor *Allium longicuspis* Regel is native to Central Asia. It is well known in pre-dynastic cemeteries in Egypt before 3,000 B.C. It was reached to China and India and grown widely since a long times and carried out to Western hemisphere by Spanish, Portuguese and French and widely grown & used in Mediterranean climates. The major garlic growing countries are France, Spain, U.S.A. Brazil and Egypt. Asia contributes major parts in total world production. It was used in England as early as first half of the 16th Century. It is frost resistant vegetable crop grown throughout the India. China is the leading country in area & production of garlic followed by India.

In India, the total area covered under garlic is about 0.26 Million hectare with production of 1.42 Million tonnes and their productivity is 5.43 tonnes per hectare of bulb. (Anonymous, 2015) [1]. Madhya Pradesh is the leading state in garlic production, its share, 0.06 Million hectare area with 0.27 Million tonnes production. The important garlic growing states are Gujarat, Maharashtra, Uttar Pradesh, Andhra Pradesh, Orissa, Tamil Nadu and Rajasthan. Garlic has higher nutritive value than other bulb crops. A colourless, odourless, water-soluble amino acid known as *Alliin* is present in uninjured garlic cloves. On injury of the cells, an enzyme, allinase comes in contact with *Alliin* and causes its breakdown into a sulphur containing product alliin (Diallylthiosulfinate). Alliin is the antibacterial substance of garlic and has the typical odour of fresh garlic.

Classical and Bayesian Estimation of Parameter of $SS_E(\epsilon)$ -distribution Under Type-II Censored Data

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Abstract

In this present piece of work, we have considered a lifetime distribution based on trigonometric function called $SS_E(\epsilon)$ -distribution and discuss its various properties which have not been added previously by host as well as any other authors. This distribution is useful and a good contribution in research under trigonometric function. We are deriving some more useful properties such as moments, conditional moments, mean deviation about mean, mean deviation about median, order statistics etc. Estimation of parameter has been done for both classical and Bayesian paradigms under Type-II censored sample. Simulation study has also been carried out to know the progress of the estimators in the sense of having smallest risk (over the sample space) at the long-run use.

Keywords: $SS_E(\epsilon)$ -distribution, Type-II censoring, Bayes estimator, MLE, Gauss-Laguerre method, risk function

1. INTRODUCTION

In statistical literature, there are several lifetime distributions available, for example exponential, gamma, Weibull, Lindley distribution etc. In past studies, calculations can only be handled when the expressions corresponding to various properties obtained in the nice closed form and when this was not achieved then rarely preferred. But in this modern era due to the advancement of computational facilities this problem have been resolved almost. Mostly, algebraic and exponential functions have been used to develop the new transformation and sometimes authors see gap in trigonometric, inverse and logarithmic type transformations. Keeping this in mind, the considered transformation is the good contribution in support of filling such gap. As we aware that the use of a single model is not found suitable in every aspect, therefore to adopt a suitable baseline model is also a quite tedious job. Study explores that exponential distribution is preferably used as a lifetime distribution but the extensive use of it is restrictive in the sense of its constant hazard rate. For simplicity and flexibility, we are also using here exponential distribution as a baseline distribution In these days, many authors are introducing transformation techniques to get a new lifetime distribution with the help of available baseline distributions some of which are popular as power transformation proposed by [6], sine square distribution by [1], [20] introduced quadratic rank transmutation map (QRTM), sinofarm distribution by [23], DUS transformation proposed by [10], minimum-guarantee distribution proposed by [11], CS transformation by [3], new Sine-G family based on [13] proposed by [16], new extension of Lindley distribution given by [17], PCM transformation by [12] and many more. In such continuation, [13] have proposed a

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DIGITAL BANKING AND ITS CONTRIBUTION IN FINANCIAL INCLUSION: EMERGING PERSPECTIVES

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Roshni Pathak**
Prof. Meera Singh***

Abstract

In any economy, financial system plays a crucial role in country's growth and development, economies like India where financial system is majorly dominated by banking system any positive technological advancement in the banking sector bring prosperity to the whole economy. The goal of this paper is to study how digitalisation and innovation in banking sector promotes financial inclusion and economic growth. Indian banking sector started its digitalisation journey in late 1980s to enhance the accessibility of banking services and to improve the quality of services provided to customers. From past two years digitalisation of banking sector gain more attention due to covid 19 pandemic. When there was restrictions and nationwide lockdown e-banking platform play significant role in saving lives and livelihood of rural as well as urban India.

Keywords: digital banking, financial inclusion, economic growth, Indian economy, digital financial inclusion, digital lending, rural India.

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Introduction

Banking system plays a significant role in economic growth and development. A robust and sustainable banking system promotes capital formation by facilitating effective financial intermediation in economy, with passage of time there is technological advancement and innovation in banking sector leads to transformation of traditional banking to digital banking. Digitalisation in banking sector means development of e- banking services and developing product through electronic channels such as the internet, automated teller machine (ATM), mobile phone etc. Earlier only a few people have internet connection and access to digital or e-banking, but now scenario have been completely changed with the penetration of internet services, e-banking and digital payment become part and parcel of everyone's life.

During the period of covid 19 pandemic digital banking and online payment system become a true blessing for nationwide money transfer programme. Direct benefit transfer (DBT) programme by government is successful only because of powerful network of digital payment system in rural as well as urban areas. Government of India take number of positive steps to make India more digital friendly economy, **Jan Dhan yojana** and its connectivity with Aadhar and mobile called **JAM trinity** is one of the productive steps towards digitalisation of economy and it also promotes financial inclusion. Digitalisation in banking sector helps in integration of whole economy and also increases the accessibility of banking services to the backward and unprivileged region.

Literature Review

Peterson, K. (2019) study the impact of digital finance on financial inclusion and



Isolation and Characterization of Ammonia Secreting Cyanobacterium *Nostoc* sp. NDUPC007 from Agriculture Fields of Varanasi

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Abstract *Nostoc* sp. NDUPC007 was isolated from agricultural fields of Varanasi, U.P., India. Cyanobacterium was characterized by morphological as well as molecular methods. 16S rRNA sequence was deposited to NCBI with accession no. KM281209.1. Chlorophyll-a content was 17.6 µg/ mg dry weight. The heterocyst frequency of both single and multiple contiguous heterocysts was 2.14%. The number of heterocysts in multiple contiguous heterocyst chains ranged from two to seven. Ammonia content in culture media increased up to the 9th day of growth and then remained approximately constant (2.34–2.43 µg/ ml) during the rest of the monitored period. Glutamine synthetase activity increased up to the 5th day of growth (maximum rate of 5.36 mM γ-glutamyl hydroxamate/ mg chl/ min). Approximately constant (3.21 mM γ-glutamyl hydroxamate/ mg chl/ min) rate of glutamine synthetase was maintained after the 9th day of growth. Algalisation with *Nostoc* sp. NDUPC007 increased the growth of rice plants. Length of radical and plumule was 2.6–3.1 cm and 14.3–17.1 cm, respectively in algalised plant, whereas it was 1.9–2.3 cm and 8.9–9.4 cm in non-algalised plants. 2.13 µg/ ml ammonia was noted in the algalised set and no

ammonia was observed in the non-algalised set on 10 days after algalisation. The findings of the experiment proved the suitability of *Nostoc* sp. NDUPC007 as potential inocula for algalisation of rice fields of Varanasi, India.

Keywords Cyanobacteria · *Nostoc* sp. NDUPC007 · Biofertilizer

Introduction

Cyanobacteria are photosynthetic prokaryotes with a range of morphological diversity, i.e., unicellular, colonial, filamentous unbranched, and with branching [1]. Three types of cells, i.e., vegetative, heterocyst, and spores are present in filamentous cyanobacteria. Heterocyst and spore perform the special function of nitrogen fixation and perennation, respectively [2–4]. Cyanobacteria have a worldwide distribution, including extreme habitats. Cyanobacteria play an important role in maintaining the structure and fertility of the soil by increasing nitrogen content, carbon content, phosphorus solubilization, and through various secretions [1, 5]. Cyanobacteria induce plant growth commonly by secretion of growth hormone, siderophore production, phosphate solubilization, and release of fixed nitrogen. These properties of cyanobacteria make them eco-friendly biofertilizers. The heterocyst is the main site for nitrogen fixation [3]. Most nitrogen fixed by cyanobacteria is not available for immediate use to plants. Nitrogen fixed by cyanobacteria is only available to plants on autolysis and mineralization of dead cyanobacteria [6]. A very small amount of fixed nitrogen is released by most nitrogen-fixing cyanobacteria during the growth period. The rate of release of fixed nitrogen was increased tremendously in cyanobacteria treated with glutamine

Significance Statement Cyanobacterium *Nostoc* sp. NDUPC007 is indigenous to the agricultural fields of Varanasi, India. It has shown the potential for continuous excretion of ammonia in the culture medium. Algalisation by this cyanobacterium induced the growth of rice seedlings. Indigenous cyanobacterium with biofertilizer potentials are sought for algalisation. The findings of the experiment prove the suitability of *Nostoc* sp. NDUPC007 as potential inocula for algalisation of rice fields of Varanasi, India.

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Evaluation of *Fischerella* sp. NDJP002 for antibacterial potentials

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Abstract

Fischerella sp. NDJP002 was isolated from agriculture fields of Chandauli, U.P., India. It was identified on the basis of morphological features. Screening of biomass extract in seven solvents i.e., ethanol, methanol, acetone, petroleum ether, chloroform and autoclaved distilled water was performed. Water extract showed maximum antimicrobial potential against test organisms i.e., *S. aureus* and *E. coli*. Compounds in water extract were purified by one round of TLC. Purified water extract produced inhibition zone of 15 ± 0.72 mm and 17.5 ± 0.71 mm against *S. aureus* and *E. coli* respectively. MIC of purified extract was less than 0.0625 mg/ml for *S. aureus* and *E. coli*. GC-MS analysis of purified extract showed nine compounds and 1, 2-benzenedicarboxylic acid as major compound (86.27%). Hence, 1, 2-benzenedicarboxylic acid is proposed as broad spectrum antimicrobial compound in the extract.

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ANTIBACTERIAL POTENTIALS OF *CALOTHRIX* SP. NDOP009

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ABSTRACT

Calothrix sp. NDOP009 was isolated from the agriculture fields of Azamgarh, U.P., India, and characterized by morphological means. Biomass of *Calothrix* sp. NDOP009 was extracted in seven solvents i.e., ethanol, methanol, acetone, petroleum ether, chloroform, n-hexane, autoclaved double distilled water, and screened for antibacterial potential. Crude extract in ethanol produced maximum inhibition zone of 10.31 ± 0.58 mm against *S. aureus*. Active compounds in cyanobacterial extract were separated by two rounds of TLC. Purified extract of a band of second-round TLC showed antibacterial activity against Gram-positive bacteria *S. aureus* with an inhibition zone of 15 ± 0.52 mm. MIC of crude extract was 0.0625 mg/ml which is less than the standard antibiotic. Compounds of a band were analyzed by GC-MS. Total twenty-four compounds were reported. 1, 2-Benzenedicarboxylic acid (61.8%) and Dehydroabiestic acid (9.72%) are major compounds in extract and might be responsible for the antibacterial properties.

Keywords: Cyanobacteria, *Calothrix* sp. NDOP009, antibacterial compounds

Introduction

Cyanobacteria are one of the ancient organisms on earth (Sergeev *et al.*, 2002). The existence of cyanobacteria has been traced up to 2.8 billion years ago (Olson, 2006). They are photosynthetic prokaryotes with wide occurrence including stressful habitats of the earth. Cyanobacteria possess characters of both prokaryotes as well as eukaryotes. Two types of classification systems i.e., botanical system and bacteriological system are followed in the classification of cyanobacteria. Cyanobacteria are identified mainly based on morphological features. Molecular parameters are also used for the confirmation of cyanobacterial strains. The role of cyanobacteria infertility in agricultural fields is well established. Cyanobacteria are a rich source of bioactive compounds i.e., mycosporine-like amino acids (MAAs) and scytonemin, toxic metabolites (anatoxin, microcystin and saxitoxin), pharmaceutical compounds (alkaloids, peptides, depsipeptides, and polyketides, etc.), iron chelators (anachelin, schizokinen and synechobactin), protease inhibitors (oscillapeptin, cyanopeptolins and micropeptin) (Rastogi and Sinha, 2009). A score of cyanobacteria has been searched for pharmaceutical compounds. Several antibacterial compounds have been isolated and characterized from cyanobacteria i.e., abietane (diterpenoid) from *Microcoleus lacustris*, Ambigol B (Aromatic), Ambiguine derivatives, Fischambiguine B and Hapalindole G (Indole alkaloid) from *Fischerella ambigua*, Borophycin (Peptide) from *Nostoc tinckia* and *Nostoc spongiaeforme*, Calothrixin

A (Indolophenanthridine) from *Calothrix* sp., Carbamidocyclophane (Cyclophane) from *Nostoc* sp. CAVN, Comnostins (Diterpenoid) from *Nostoc commune*, Cyanobacterin (Aromatic) from *Scytonema hofmanni*, Muscoride A (Linear peptide) *Nostoc muscorum*, Nostocine A (Extracellular pigment) from *Nostoc spongiaeforme*, Scyptolin A (Cyclic depsipeptides) from *Scytonema hofmanni* PCC 7110, etc (Dwivedi, 2019). Reports on antibacterial potentials of cyanobacteria isolated from Azamgarh, U.P., India are lacking. Hence, this experiment was designed to study the antibacterial potential of cyanobacterium *Calothrix* sp. NDOP009 isolated from district Azamgarh of U.P., India.

Material and Methods

Isolation, Purification, and cultivation of cyanobacteria

Cyanobacterium *Calothrix* sp. NDOP009 was isolated from soil samples of the agricultural field of Azamgarh, U.P., India following procedure as described by Singh *et al.* (2017). The cyanobacterial strain was purified by repeated streaking. The purified strain was grown in nitrogen-free liquid BG-11 medium (Stanier *et al.*, 1971) in a culture room maintained at 28 ± 20 C and illuminated with fluorescent light of 12 W m^{-2} .

Identification of cyanobacteria

The cyanobacterium was viewed at 400x and 1000x using Olympus 21Xi microscope. Morphological parameters

