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Optimization of process parameters for protease production by Bacillus licheniformis F1 in submerged fermentation using response surface methodology and its application as a laundry additive

SAMRITI SEN • NIVEDITA SHARMA • GITANJALI VYAS
Received: April 25, 2014; Revised: June 12, 2014; Accepted: June 25, 2014

ABSTRACT A potential protease producing bacterial strain was isolated from mushroom compost and identified as Bacillus licheniformis F1 using 16S rRNA gene technique and deposited in NCBI gene bank vide accession number |KF769487|. The aim of this study was to enhance protease production by optimizing various process parameters through the statistical approach under submerged fermentation from this isolate. The optimum levels of these four parameters were determined employing the response surface central composite design (CCD). A maximum xylanase activity of 65.10 IU/ml had been obtained with 2 % NH4Cl, 9 % tryptone, 0.2 % CaCl2 and 0.2 % ZnSO4.

KEYWORDS Protease, RSM, Bacillus licheniformis, laundry additive, optimization

INTRODUCTION Proteases refer to a group of enzymes whose catalytic function is to hydrolyze proteins (Jaouadi et al. 2009). There are several kinds of proteases such as alkaline neutral, acidic, serine-, metallo and carboxyl proteases. Proteases are classified according to their structure/properties of the active site. They perform both degradative and synthetic functions (Raq et al. 1998). Proteases represent the class of enzymes which occupy a pivotal position with respect to their physiological roles as well as their commercial applications.

Among the different types of microbial proteases, the commercially most important are the alkaline proteases, especially those from the bacterial sources and these alkaline proteases account for 89 % of the total protease sale. This huge market of alkaline protease is due to their vast application in multifaceted industrial sectors such as food, pharmaceutical, detergent, textile and tanning industries. Besides, these proteases are also used for the hydrolysis of hair, feather and horn for the production of valuable products and in peptide synthesis and resolution of racemic mixtures of amino acids etc. (Rai et al. 2010).

Optimization of medium by the classical method involves changing one independent variable keeping the other factors constant. The conventional methods for multifactor experimental design are time consuming and are incapable of reaching the true optimum since potential interactions among process variables are ignored. On the other hand, an experimental design based on the statistical modelling can be a very useful tool for evaluating the interactions between a set of independent experimental factors and observed responses, while at the same time reducing the number of experiments required to determine optimal conditions. So, in this study along with optimizing the individual factors we have examined the interactive effects between physico-chemical parameters using response surface methodology to enhance the enzyme production. The produced enzyme has thus been purified and has been found as a good potential laundry additive.

MATERIALS AND METHODS Isolation and identification Mushroom compost samples were collected from different sites of Solan district of Himachal Pradesh. To enrich the compost sample, 1 g of skim milk powder was added, water was sprinkled and it was incubated at 50±2 °C for 3 days. Isolations were done by

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Effect of spacing and training levels on growth and yield of capsicum under polyhouse in North-Bihar conditions

UDIT KUMAR • GIRISH CHANDRA
Received: Nov 16, 2013; Revised: Jan 9, 2014; Accepted: March 3, 2014

ABSTRACT An experiment was carried out to study the effect of spacing and number of shoots on growth and yield of capsicum variety Indira under polyhouse during 2009-10 and 2010-11 at polyhouse unit, Department of Horticulture, Tirthu College of Agriculture, Dholi, Muzaffarpur, Bihar. There were three levels of spacing 45 x 30 cm (4.4 plants/m$^2$), 45 x 45 cm (2.94 plants/m$^2$) and 45 x 60 cm (2.22 plants/m$^2$) and three levels of numbers of shoots per plant viz. two shoots, three shoots and four shoots. The experiment was laid out in factorial randomized block design with three replications. Among the different spacing, S1 (45 x 30 cm) spacing recorded significantly higher plant height (147.21 cm.) than the other spacing but spacing S3 (45 x 60 cm) recorded significantly higher number of leaves per plant (105.67), number of flowers per plant (13.03), number of fruits per plant (9.65) but the maximum fruit yield (71.39t/ha) was recorded under spacing S1 (45 x 30 cm) with regards to the number of shoots per plant. The treatment two shoot per plant recorded significantly higher plant height (144.36 cm), number of leaves (116.25) whereas retaining four shoots per plant recorded significantly higher number of flowers per plant (13.04), number of fruit per plant (9.30), fruit yield (65.35 t/ha). But for the common farmers growing capsicum cv. Indira with closer spacing S1 (45 x 30 cm) and training level (four shoots per plants) will be more profitable under polyhouse.

KEYWORDS Capsicum, spacing, training, polyhouse

INTRODUCTION Bell pepper (Capsicum annum L.) is commonly known as sweet pepper or capsicum. Bell pepper has attained a status of high value crop in India in recent years. In India, it occupies a pride of place among vegetables cuisine because of its delicacy and pleasant flavor coupled with rich content of ascorbic acid and other vitamins and minerals. Nutritionally, bell pepper are rich in vitamins particularly Vitamin A (180 IU) and vitamin C. One hundred gram of edible portion of capsicum provides 24 kCal of energy, 1.3 g protein, 4.3 g carbohydrates and 0.3 g fat (Anon 2007).

Basically bell pepper is a cool season tropical crop and lacks adaptability to varied environmental conditions (Yoon et.al. 1989). Despite its economic importance, growers are not in position to produce good quality capsicum with high productivity due to various biotic (pest and diseases), abiotic (rainfall, temperature, relative humidity and light intensity) and crop factors (flower and fruit drop). Due to erratic behavior of weather, the crop grown in open field are often exposed to fluctuating levels of temperature, humidity, wind flows etc. Which ultimately affect the crop productivity adversely (Ochigbo and Harris 1989). Besides this, limited availability of land for cultivation hampers the vegetable production. Hence, to obtain the good quality produce and production during off season, there is a need to cultivate capsicum under protected condition such as green house or polyhouse.

The research for new avenues has led to development of high-tech precision agricultural system, greenhouse the latest word in Indian agriculture is one such means where the plant are grown under controlled or partially controlled environment resulting in higher yields than that is in possible under open conditions (Navale et al. 2003). Polyhouse production technology of vegetable emphasizes the need for having appropriate plant densities and optimum
Economics of finger millet cultivation in hills of Kumaon region of Uttarakhand

MANISHA PANT • SK SRIVASTAVA
Received: Dec 25, 2013; Revised: Jan 12, 2014; Accepted: Feb 10, 2014

ABSTRACT  India leads the world in production of millets. In 2011, India produced 12,710,000 tonnes of millets, becoming the highest producer around the globe. While wheat and rice might provide only food security, millets produce multiple securities (food, fodder, health, nutrition, livelihood and ecological) making them the crops of agricultural security. In Uttarakhand traditional crops like, finger millet, barnyard millet, black soybean, horse gram etc. are cultivated in a wide range of soils and under diverse climatic conditions. The production of these crops in state during 2010-11 was around 821076 mt, out of which finger millet accounted for 170484 mt. The area under this crop has not amplified much in the recent years. The fact that this crop has with stand the competition from major cereals in past 40 years and still maintains substantial area is a testimony to their resilience and special adaptation. The study was based on a sample survey of 60 farmers randomly selected from mid hills and high hills of two blocks of Almora district of Kumaon division of Uttarakhand with aim to examine the profitability of finger millet crop. The study showed that finger millet crop was found to be subsistence crops on both the altitudes of hills. It was observed that percentage share of area under finger millet crops in gross cropped area was 13.68 % which was highest among all the traditional crops in the study area. The per ha cost of cultivation of finger millet was about 13165. The crop was profitable if only paid out cost (i.e. cost A) was taken into account. This crop was grown due to its wider adaptability to harsh climate of the study area but there is a need to strengthen extension programmes to promote this crop. The area has vast potential to grow this crop on commercial basis but there is need to tap this potential to benefit the growers. There is need to provide efficient infrastructure support so as to maximize the returns of the growers.

KEYWORDS Cost of cultivation, profitability, rainfed, hills, traditional crop, economics, finger millet

INTRODUCTION  India is almost self sufficient in food production but, there exists regional variation among states. Some states are surplus in food production, while others (especially hill states) are deficient (Srivastava 2011). The traditional agriculture aimed at increasing the production through two dimensions viz., expanding the cultivable area and increasing the productivity. There is little likelihood of meeting the requirement or demand by depending only on first of the above. Hence, further increase in crop production will have to be achieved by increasing yield levels and cropping intensity as well as by bringing uncultivable waste land and dry land under cultivation. Thus, for attaining food security on sustainable basis farmers have to use land more efficiently and effectively. This can be achieved by reclamation of the waste land, intercropping with the forests, wasteland agriculture and improved dry land agriculture (Sharma 2005). Technologies which can successfully exploit the full potential of such areas especially the rainfed need to be extended. The hill perspective based development strategies are essential for formulating farmer responsive plans, giving due considerations to the nature of marginality, fragility, diversity and niches of each area. It will not only help ameliorate the impact of marginalization of hill communities but also in achieving social equity by building on the comparative advantages of key land sources (Pratap 2011). One of such
Socio-economic status of terrace-cultivators in Darjeeling Himalaya region, West Bengal

B SUBBA . PB CHAKRABORTY
Received: Nov 28, 2013; Revised: Feb 8, 2014; Accepted: Feb 20, 2014

ABSTRACT Socio-economic scenario of an area is determined by its physiographic nature, but also the physical environment. Of these, climate is the primary factor that decides nature of socio-economic activities. The study was, therefore, undertaken during 2010-2012 in four villages viz. Sangsay Busty, Upper Dalapchand Busty, Lower Pudung Busty and Lower Sindebong Busty of Kalimpong sub-division of Darjeeling district, situated at approximately at 5500, 4500, 3500 and 2500 ft. altitudes respectively. Population of the village situated at lowest altitude, is relatively higher than the villages at higher altitudes. Moreover, male and female population in 20-40 years age groups is 27.55 %. But, it is 66.2 % in the study area as a whole, which indicates that the area has a good concentration of labour-force. On the contrary, concentration of female labour force is relatively higher at higher altitudes. Economy of the most of the villages depends on agriculture. But, in Lower Pudung Busty sources of family income are mostly service and business. Nevertheless, mean capita per day (PCPD) income of the area is about 45.97, which indicates people, in general, live above poverty line (≥ 28 PCPD). But virtually, (60-70 %) people in the villages at higher altitudes live below poverty line indicating that these villages are dominated by poverty-stricken people. As people depend mostly on agriculture, the size of land holding owned by them also plays crucial role. In study area more than 45 % of farmers own less than one acre of land while 5-6 acres of land areas are owned by only about 3 % farmers. But, there is no farmers having less than1 acre land in lowest altitude, which indicates that farmers in lower altitudes are more economically prosperous than the farmers having at higher altitudes

KEYWORDS Altitudes, labour-force, land holding, per capita income, poverty, terrace

INTRODUCTION The development of hill areas depends not only on physical infrastructure but also on social and economic infrastructure (Pathak 2002). However, more availability of infrastructure facility does not lead to a positive impact on the level of development unless people have access to the facility (Canning and Bennathan, 2000, Fernald, 1999, Khandeker 1989) like education. Villages at lower altitudes have better access to educational facility. In areas of high altitude, where the road network is poor, literacy rate is also low. Due to topographic variation, distribution and provision of infrastructural facilities vary, as the terrain on the hilly areas becomes a constraint in the provision of infrastructural facilities resulting socio-economic disparities (Majumder 2003). Such disparities also exist on uphill and downhill areas. Land holding is the other primary resource support and provider of social and economic means of livelihood generation, occupational contemplation and enterprise creation (Roy 2008).

In fact, land, labour and capital are the basic needs of crop-livestock enterprises on slope land areas. Sharma et al. (1995) reported that prevalence of shifting cultivation; land tenure system, village leadership pattern and lack of finance, communication and marketing facilities are the major constraints in improving socio-economic condition of people of hilly regions (Nilg 1997, Sen 1993). The present study was, therefore, taken up to look into the socio-economic condition of selected agrarian society of Darjeeling Himalayan Region.
A study on behaviour of arrivals and prices of fruits in Narwal market of Jammu

ANIL BHAT • MANISH SHARMA • SUDHAKAR DWIVEDI • SP SINGH • ARTI SHARMA

ABSTRACT Fruits occupies a place of importance in the horticultural wealth and economy of the country. The present study was conducted in Narwal market of Jammu district. The average monthly arrivals and prices for the period w.e.f 2007-08 to 2010-11 were collected from Narwal market of Jammu and it was found that the market arrivals and prices of fruits varies to each other. The analysis shows that the prices move contrary to arrivals. It has been found that the seasonal nature of fruits creates glut in the market which leads to sharp fall in prices during the post harvest season and affects the orchardists adversely. The highest market arrivals in the Narwal mandi of Jammu commensurate with the harvesting date of the produce and it was found that peak market arrival period in case of banana was from July with arrivals of 16008.33 q to October with arrivals of 27451.67 q whereas in case of papaya, the arrivals were highest (4525.00 q) in April and in guava in the month of March (2335.00 q). It was also noticed during the analysis that the major portion of the farmers’ produce was sold at the lower price in the post harvest period thereby lowering their incomes.

KEYWORDS Prices, fruits, market, economics, seasonal variations, Narwal, Jammu

INTRODUCTION India has the unique distinction to grow almost all the varieties of fruits and vegetables. India is second largest producer of fruits in the world (9 %) after China. India is the second largest producer of fruits and vegetables in the world with 81285 thousand metric tonnes production of fruits and 162187 thousand metric tonnes production of vegetables for the year 2012-13. Major fruits cultivated in India are banana (32.61 %), mango (22.14 %), Citrus (12.41 %), papaya (6.61 %) and apple (2.35 %) (NHB 2013). It is projected that India will touch 98 million tonnes (Banerjee 2009). Among the fruit crops, banana, papaya and guava are major commercial fruit crop widely consumed both as fresh fruit and shakes. Guava (Psidium guajava L.) is the fourth most important fruit crop after mango, banana and citrus in India and occupies the area of 178 thousand ha and production 1975 thousand MT with average productivity of 11.1 MT per hectare fruit per year in 2007-08. It is considered as one of the exquisite, nutritionally valuable and remunerative crop. The fruit is an excellent source of ascorbic acid (260 mg/100 g), pectin (1.15 %), minerals like phosphorous (23-27 mg/100 g), calcium (14-30 mg/100 g) etc as well as vitamins like vitamin A, thiamine, riboflavin, pantothenic acid and niacin etc. Guava is normally consumed as fresh as desert fruit. It is also stewed and used in sauce, ice-cream, butter, marmalade, chutney etc, but its diversified utilization gives potential to combat malnutrition by developing innovative and novel products which could be prepared from guava pulp as such and in combination with other fruit pulp by blending. Papaya (Carica papaya L.) is the fifth most important crop in India, which is cultivated in about 80 thousand ha of land and production of 2666 thousand MT with average productivity of 33.4 MT ha⁻¹ in 2007-08. The fruits are excellent source of vitamin A (2020 IU/100 g) next to mango (2500 IU/100 g) and also a rich source of other vitamins like thiamine, riboflavin, nicotinic acid and ascorbic acid. Papayas (100 g) contains 9 % of the Dietary Reference Intake (DRI) for Cu, 6-8 % of the DRI for Mg, but less than 3 % of the DRI for other minerals. Jammu and Kashmir state is well known for its horticultural produce...
Deviation in physical and physiological seed attributes within a seed lot of soybean [Glycine max (L.) Merrill.]

BIRENDRA PRASAD • SHAMBHOO PRASAD • RAJENDRA PRASAD

Received: May 25, 2014; Revised: June 22, 2014; Accepted: June 25, 2014

ABSTRACT Seed quality variation as influenced by seed position on the mother plant and ovule position within the pod were studied as possible with in plant components contributing to heterogeneity in quality of seeds within lots of soybean [Glycine max (L.) Merril.] cultivar PS-1092 were grown in two successive years under North-West Himalayan Agri-system. The seed quality along with subsequent seedling growth was evaluated within the plant for different stem type and pod section. The largest seed size was obtained on main stem on the mother plant where the earliest pods were formed whereas within the pod distal position had greater seed weight. Seed germination % was greatly influenced by different stem type and seed position within the pod on the mother plant and significantly higher germination % was recorded for main stem type over primary and secondary branches while seed attached at distal end within the pod had greater germination over middle and proximal location within pod. The subsequent seed and seedling vigour in terms of seedling length, fresh and dry weight of seedling, vigour index, relative growth index (RGI) and earlier germination as indicated by lower value of mean germination time (MGT) and time to 50 % germination (T50) as well as electrical conductivity of seed leachates were varied in different stem type and pod section. On the basis of these parameters the seeds obtained from main stem exhibited greater vigour over primary and secondary branches respectively. However, in pod section the seed attached at distal end with in the pod exhibited greater seedling vigour than middle and proximal end of the pod section.

KEYWORDS Seed quality, soybean, heterogeneity, stem and ovule position

INTRODUCTION Soybean [Glycine max (L.) Merril.] being a potential oil and protein crop for narrowing the oil and nutrition gap, occupies an important place in agricultural economy of India. A handsome amount of seed quality variation is probably observed within and between soybean seed lots. The heterogeneity within a seed lot has to arise mainly from variations between and within mother plants. Pod and seed position on the mother plant is one of the main factors of within plant that may account for part of the heterogeneity in physical or physiological seed attributes. The top main stem seeds were heavier than seeds from bottom main stem or branches and performed better in conductivity and germination tests (Ramseur et al. 1984). Thus position of the pod influenced seed quality components directly and through its association with time to pod set. Differences in seed maturity or in time left for seed ageing on the mother plant and position of seed in the pod may explain variation in physiological seed attributes. Seed maturity is an important factor explaining seed position effects but little is known about the relations between the duration of pod growth, development, maturation and ageing and physiological seed quality attributes for individual seeds (Keigley and Mullen 1986). Environmental conditions around the pod i.e. light, temperature and relative humidity and internal factors i.e. local sink-source relation may contribute to response on physiological seed attributes. Here we hypothesize that both the variation in time of individual pod growth, development, maturation and ageing until harvest and the pod and seed position on the mother plant significantly contribute to the heterogeneity in physical and physiological quality attributes of seeds harvested from a soybean.

Therefore, the experiment was laid out with the objective to examine the effect of pod position at different
Factors contributing the success of rural dairy entrepreneurs in Jorhat district of Assam

SHWETA PRIYAMVADA · BK MISHRA · DEEPAK BHAGAT

ABSTRACT Dairy development in Assam has in recent years also reinforced its facilitating role in increasing opportunities for income and employment and upliftment of poorer sections of the society with the broader perspective of a complete rural transformation. Under this situation, the selection of potential dairy entrepreneur becomes a crucial factor in order to ensure entrepreneurial success in this sector. An analysis of the empirical literatures regarding the characteristics of entrepreneurs, establishes direct relationship between the need for achievement, locus of control and risk taking propensity with success in most cases. There are many other factors including need for dominance, passion for work, time preference. Apart from these psychological factors, the demographic characteristics and infrastructural facility and institutional support do also play a crucial role in decision related to dairy entrepreneurship in Jorhat district of Assam. This paper attempts to investigate factors that determine entrepreneurial selection and success of dairy entrepreneurs in Jorhat district of Assam. An effort was also made to find out the correlation between the variables and relations between those variables and sales (income from dairy enterprise) to find out factors having significant impact on entrepreneurial success among the dairy farmers. Results indicate that the performance appears to be systematically driven by achievement motivation, institutional support and negatively by age.

KEYWORDS Dairy entrepreneurs, rural development, agribusiness, entrepreneur selection

INTRODUCTION

With peace and normalcy gradually returning to Assam, small-scale ventures like dairy farming are increasingly gaining popularity in the region. This is not just engaging the youth in the socio-economic development of the region, but is also promoting a sense of entrepreneurship. The activities of dairy farming in Assam were initiated with the basic concept of procurement, processing and distribution of milk aiming at economic upliftment of rural milk producers on one hand and to help urban consumers to get quality milk at a reasonable price on the other. The milk production of Assam leaves a huge gap with the actual demand. Per capita availability of milk during 2010-11 was 74 g/day in comparison to the all India figure of 246 gm/day. Total milk production in the state was 833 million litres against a requirement of 2308 litres in the year 2010-11 (PDD 2013).

Established as the new capital in the closing years of the 18th century by the decaying and declining Tunkhungia Ahom Dynasty, Jorhat as the name signifies, was just a couple (Jor) of marts (Hut), viz., Chowkihut and Macharhut, which lay on the eastern and the western banks of the river Bhogdoi. Total geographical area of Jorhat district is 2,859.35 sq km. equivalent to 3.63 % of the state. The district consists of 3 civil subdivisions, 8 development blocks and 111 panchayats with 866 revenue villages. Jorhat district consists of one municipality and 6 towns. The present estimated production of milk in the district is about 70000 litres per day against the total demand of 160000 litres per day. The gap is bridged by importing milk from Dimapur, Guwahati and other places. Though, this lack of milk supply vs. high milk demand presents an opportunity for milk entrepreneurs, ground realities shows that there are very less number of cases of...
Mineral characteristics of buckwheat (Fagopyrum esculentum Moench) genotypes grown in Sangla region of Himachal Pradesh

DIKSHA DOGRA  CP AWASTHI

Received: April 14, 2014; Revised: June 20, 2014; Accepted: June 25, 2014

ABSTRACT The contents of potassium, phosphorus, calcium, magnesium, zinc, manganese, copper, iron and sodium in various samples of buckwheat were analyzed. Wide variations in potassium, phosphorus, calcium, magnesium, zinc, manganese, copper, iron and sodium ranged from 441.3 to 576.3 mg/100g, 242.9 to 370 mg/100g, 50.6 to 95.5 mg/100g, 186.5 to 303 mg/100g, 1.9 to 4.2 mg/100g, 1.1 to 1.7 mg/100g, 0.62 to 0.80 mg/100g, 3 to 4.4 mg/100g and 9.3 to 20.8 mg/100g, in that order. There were variations in the contents of these minerals among various buckwheat samples examined. Nutritional contribution of buckwheat as a dietary source of these minerals was estimated.

KEY WORDS Buckwheat, grains, potassium, phosphorus, calcium, magnesium, zinc, manganese, copper, iron, sodium

INTRODUCTION From the diverse range of plants (about 6000 species), which can potentially be used for human nutrition, at present fewer and fewer species are used. World population dominate more and more on three cereal species wheat, maize and rice. Diversifying production and consumption of a broader range of plant species including those currently identified as ‘underutilized’ can, therefore, contribute significantly to improve health, nutrition and ecological sustainability.

Although many plants from the family of Chenopodiaceae are used for human nutrition (e.g., spinach, beet etc.), only three have gained importance as grains, so-called pseudocereals, worldwide. Besides amaranth (Amaranthus sp.), these are quinoa (Chenopodium quinoa) and buckwheat (Fagopyrum esculentum) that have persisted through centuries of civilization. Buckwheat is a crop originating in the southwest China. Although buckwheat production is concentrated in China, Japan and North America, it is also produced in Europe, India, Tibet, Tasmania, Australia, Argentina, Bhutan and numerous other countries (Kreft and Germ 2008).

Buckwheat (Fagopyrum esculentum Moench) is an important human food in some area of the world. In India, the crop is grown from Jammu and Kashmir in the west to Arunachal Pradesh in the east. It is becoming popular in the state of Himachal Pradesh, Uttarakhind and Jammu and Kashmir due to suitable climate. In the state of Himachal Pradesh, buckwheat is grown in Kinnaur, Lahul Spiti and Sirmour districts. Since, the crop is adapted to temperate climate; hence, Himachal Pradesh can play an important role in production of this crop. Buckwheat neither is a cereal grain nor related to wheat; in fact, it is a seed and handled in a similar way like any other common cereal grains.

Buckwheat commonly known as kathu, fafar, ogle or bharesh is a herbaceous erect annual meliferous plant. It is an important pseudocereal crop in higher hills and mountains grown especially above 1500 msl up to 4500 msl in the Himalayas. It is grown on a commercial scale in about 1500 ha in the Himalayan region (Phogat and Sharma 2000).

Minerals are well known to be essential for optimum human nutrition. Buckwheat is reported to contain appreciable amounts of minerals. The nutritive value of hulled and dehulled buckwheat grain analysed and reported calcium and phosphorus content to vary from 0.20 to 0.28 and 0.30 to 0.36 g/100g on dry matter basis (Gupta et al. 2002). Another study, zinc observed in different fractions of common
Effect of packing and storage on the shelf life and quality of ber cv. Umran

VIKAS VERMA • VK RAO • SK SHARMA • SHAILESH TRIPATHI

ABSTRACT

This study was carried out to extend the quality and shelf life of ber fruits by low-cost effective packaging materials. There were 48 treatment combinations consisting of two packing materials (Card Board Box; Polythene Net bag) three size of the retail packing units (250 g; 500 g; - 1 kg; - 2 kg) and six storage periods (Initial; 2 days; 4 days; 6 days; 8 days; 10 days). The fruits of ber cultivar Umran were harvested at optimum maturity from Horticulture Research Centre, Patarchatta, Pantnagar, Udham Singh Nagar, Uttarakhand. Ber is one of the commercial fruit crops grown in the tropical and sub-tropical region. It is considered to be "poor man’s apple" due to its high nutritional, medicinal value and low cost. Ber fruits have an advantage that fruits are available in market during lean period and to ensure remunerative prices to growers. However, the storage life of ber is extremely short, hardly 2-4 days at ambient conditions and thus early perishability of fruit poses a problem. Among the various packaging materials evaluated for packing of ber fruits, cardboard boxes were found suitable and economically viable containers involving least cost (₹ 3.00). Although physico-chemical properties were concerned during 10 days storage, the maximum acidity and ascorbic acid along with minimum physiological loss in weight and spoilage percentage were found in cardboard boxes packed fruits. However, maximum physiological loss in weight, spoilage, TSS, total sugars of fruits were obtained in fruits packed in polythene net bags. Sensory scores for overall acceptability were better in fruits packed in cardboard boxes. Therefore, storage of 100 kg ber fruits packed in cardboard boxes showed better quality as compared to polythene net bags under ambient storage. Economics computed showed feasibility as on a total input of Rs. 1363.32 and Rs. 3000 is earned as gross returns with a net return of Rs. 1637.68 with 2.20 B: C ratio.

KEYWORDS

Ambient storage, B: C ratio, containers, physio-chemical, poor man’s apple, sensory scores

INTRODUCTION

Ber or Indian jujube (Zizyphus mauritiana Lam.) belongs to the genus Zizyphus of the family Rhamnaceae and the order Rhamnales. It is one of the important dryland fruit crops grown throughout India. Zizyphus species are distributed between 34°S and 51°N latitude, and up to 2,800 m above mean sea level (Bailey 1947). Liu and Cheng (1995) reported that the Indo-Malaysian region i.e., south and south-east Asia is the centre of both evolution and distribution of the genus Zizyphus. It is a fast growing tree, with an average bearing life of 25 years; branches typically have a leaf and a thorn at each angle. Fruits are yellow, green, reddish or dark brown, but have a yellow to pale-orange colour when ripe. The fruits are round, oval or oblong in shape (Hussain et al. 2013). Ber is an important fruit crop of India and is considered to be “poor’s man apple” due to its high nutritional, medicinal value and low cost (Gajbhiya et al. 2003). The ber cultivar ‘Umran’ is commercially cultivated on a large scale in Punjab and Haryana states of India. It was developed from germplasm from Rajasthan at the Fruit Research Station at Bahadurgarh, Punjab. It fetches the highest price. The fruit matures in the mid-season (February to March) and ripens during mid-March to mid-April. It has a pleasant flavour and excellent dessert quality. Umran fruits have a good keeping quality and can withstand long transportation. The fruit is also known locally as Ketha, Ajmeri and Chameli (Azam et al. 2006). Ber fruit has an added advantage that, it is available when there is scarcity of other fruits in the market (Gajbhiya et al. 2003). With the increase in its popularity among the people, it is now

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Standardization of organic manure levels for better growth, yield and economics of rice bean (Vigna umbellata L.) under Central Himalaya

DK SHUKLA • TEJ PRATAP • BIRENDRA PRASAD

Received: Oct 5, 2013; Revised: Dec 28, 2013; Accepted: Jan 10, 2014

ABSTRACT A field experiment was conducted during Kharif 2011 and 2012 to find out the optimum levels of organic manures under organic management for higher yield of rice bean under rainfed condition at College of Forestry and Hill Agriculture, Hill Campus, Ranichauri, Tehri Garhwal Uttarakhand. Results exhibited that increasing levels of organic manures the plant growth in term of plant height, yield attributing characters i.e number of pods/plant, number of grains/pod, pod length (cm) and 1000 grain weight (g)) and ultimately yield of rice bean also were increased as dependent manner. Highest value of plant height, yield attributing characters and yields (Grain:1215 kg/ha and Straw: 2745 kg/ha) was recorded with 100% RDF (20 kg N and 60 kg P₂O₅/ha) which was at par with 50% RDF +2.5 tonne vermicompost and vermicompost @ 7.5 tonnes/ha. B:C ratio (2.07) was recorded maximum with 100% RDF. Use of vermicompost and FYM was not found economically suitable due to high cost of these manures.

KEY WORDS Organic manures, plant growth, yield, economics, ricebean

INTRODUCTION In Uttarakhand hills, rice bean (Vigna umbellata L.) a traditional crop is predominantly grown as rainfed crop in mixed-cropping system with finger millet, barnyard millet and grain amaranth. It posses high yield potential and variety of uses (Chandel et al. 1988). The nutritional quality of ricebean is superior than many other legumes belong to Vigna category (Katoch 2013). Hundred grams of rice bean seeds contain 25.0 gram protein, 0.6 g fat and 59.6 g carbohydrate (Kumar 2010). It is a rich source of calcium, iron and phosphorus. The productivity of rice bean is very low in this region because of poor nutrient status of soil and limited use of nutrients. Farmers inhabiting in this region are having poor resource base with marginal and scattered land holdings. High cost and timely unavailability limit the use of fertilizer not only in rice bean but other crops also. Judicious application of organic and inorganic sources of plant nutrition is essential for higher crop productivity in Himalayan region (Pratap and Dutta 2010). A strategy has to be taken to harvest full potential of on-farm organic resources particularly FYM and vermicompost to meet the nutrient requirement of the crops under North-Western Himalayan agri-system. Besides, their importance in meeting the nutrient requirement of the crops, these organic manures are also known for ameliorating materials in acidic soils. However, information on the effect of nutrient management solely through organic resources on ricebean is still lacking. In view of above facts the present study was under taken to optimize the dose of organic manures for getting higher yields of ricebean under rainfed condition of North-Western Himalayan region.

MATERIALS AND METHODS A field experiment comprising 9 treatments viz. FYM and Vermicompost 2.5, 5.0, and 7.5 tonne ha⁻¹, respectively, 50% RDF+2.5 tonnes ha⁻¹ vermicompost, 100% RDF and control (No fertilizer) was conducted during Kharif season of 2011 and 2012 at College of Forestry and Hill Agriculture, Hill Campus, Ranichauri (1740-1750 m amsl). The experiment was laid out in randomized block design with 3 replications. Farm yard manure and vermicompost used in
ABSTRACT

Study to assess the root yield and profitability of some of the new hybrids and prevalent varieties of radish, a field experiment was conducted during kharif season, 2011-2012. The trial was replicated thrice in Randomized Complete Block Design (RBD) with 11 hybrids/ open pollinated varieties. Observations for most of the plant morphological parameters and quality aspect such as ascorbic acid etc were recorded mainly at first harvest of crop. In addition, marketable root yield per unit area and profitability of crop including Benefit-Cost ratio had also been worked out. In this investigation, open pollinated variety Pusa Chetki, was found earliest in respect to first harvest, taking about 45 days from the date of sowing, whereas locally grown radish Doonagiri Gol was observed late in 1st harvest (62 days). With respect to marketable root yield, hybrid Shagun Meeno with 402.73 q ha⁻¹ was recorded the highest yielder in the experiment. This yield was 24.68, 56.66 and 128.74 % higher over standard checks Japanese White, Doonagiri Gol and Pusa Chetki, respectively. The maximum net profit of Rs. 72,602.00 ha⁻¹ along with highest Benefit-Cost ratio (1.82) was also obtained in hybrid Shagun Meeno. Not only this, this hybrid was also less pungent compared to other hybrids/ varieties. The roots of this variety were smooth and attractive. The other hybrid which proved second best in root yield and net profit was Mahyco Hybrid-11 (341.98 q ha⁻¹).

KEYWORDS Radish, Raphanus sativus L., off season vegetable, yield, quality

INTRODUCTION

Nature has endowed India with many precious gifts, wherein lies its immense potential for the agriculture sector. The vast diversity of land, soil and agro climatic conditions offer us unique competitiveness to grow a wide range of vegetable crops. Among different vegetable crops grown in India, radish (Raphanus sativus L.) has a unique place in vegetable production. It is a vegetable which is grown from seashore to higher mountains for its young roots, which are either eaten raw as salad or cooked as vegetable. Radish cultivation in Uttarakhand is a new vegetable enterprise, as its commerciality in the state known to be started only 20-25 years ago. During 2011-12, the state occupied 4,663 ha area under radish cultivation with an annual production of 57,957 metric tonnes. The crop productivity was 12.43 M T per hectare (Anon 2013).

The growth and yield of radish greatly depend on soil and climatic conditions. Varieties differ in their soil and climatic requirements for optimum performance. India being a vast country with varied agro-climatic regions viz. temperate, subtropical, tropical and coastal tropical humid regions, therefore, a single variety may or may not be suitable for all the agro climatic regions. Hence, under these circumstances area specific selection of varieties is need of hour.

Although, a number of radish varieties/hybrids have been recommended/released for the irrigated plain conditions of India but their number for rainfed Uttarakhand is almost negligible. The varieties available with hill farmers so far, are either local type or quite old with low productivity, due to one or other reasons. Because of variations in climate (Kumar 2010), the hill farmers can also not as such choose the varieties/hybrids for their area which have been very commonly grown in the irrigated conditions of plain.
Studies on varietal and crop geometry response on production and quality in Capsicum (Capsicum annuum) under naturally ventilated polyhouse

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Received: Jan 8, 2014; Revised: April 23, 2014; Accepted: May 10, 2014

ABSTRACT Experiments were conducted under polyhouse conditions for two years to standardize suitable hybrids/cultivars and planting density under high hill conditions of Uttarakhand. Seven hybrids/cultivars (Mahabharath, Manhattan, Natasha, Swarna, Tanvi, Orobelle and California Wonder) and four spacing were taken under study at VCSG College of Horticulture, Bharsar, Pauri Garhwal. To standardize the crop geometry, seven genotypes were planted at a distance of 30 x 30 cm and 45 x 45 cm. The experiment was laid out in randomized block design with 4 replications. Highest yield was observed in Mahabharath hybrid in 30 x 30 cm spacing with marketable yield of 7.87 kg/m². Hybrid cultivars were superior to open pollinated cultivars in most or yield and yield contributing characters. Highest ascorbic acid (103.2 mg/100g) and acidity (0.384 %) was recorded in California wonder and Manhattan, respectively. The incidence of powdery mildew was less at wider spacing than the close one with minimum incidence was recorded in Mahabharath (0.205 %). Shelf life of varieties was evaluated in the month of September in individual shrink wrapping (ISW) and open conditions. All varieties could be stored for 20-30 days without losing much water and other quality. ISW was proved better than open stored capsicum in terms of less water loss (<10 %) and less rotting percentage.

KEYWORDS Capsicum, spacing, fruit yield, powdery mildew, shelf life, storability

INTRODUCTION Varied agro ecological conditions offer vast scope for production of vegetables, fruits and other horticultural commodities in Himalayan regions. In general, profits are higher in off season vegetable crops provided climatic constraints are overcome by adopting protected cultivation technologies (Bisht 2012). The purpose of growing crops under green house conditions is to extend cropping season and to protect them from adverse environmental conditions (Sharma et al. 2010, Jai paul et al. 2011).

In India, protected cultivation is gaining momentum in expansion of area and productivity of horticultural crops in a faster rate. It is estimated that about 2000 ha area including net house and shed houses are under protected cultivation (Singh and Malhotra 2012). In spite of favourable conditions, only 200 ha area have been brought under protective cultivations of vegetables and flowers in the state (Anon 2012).

Among various vegetable crops, capsicum fits best in summer seasons as off season crop. Capsicum is an important commercial vegetable crop of mid and high Himalayan region and gives maximum profit to farmers during early and off-season. It is considered to be an export potential commodity. Generally, crop requires warm temperature ranging from 20 to 25 °C for its growth and development. Especially high hills and mid areas are not considered suitable for open field cultivation.

In natural ventilated conditions, capsicum can be cultivated throughout the year except 2-3 months in winters. However, inclement weather accompanied by fluctuating temperature, which is a common feature in hilly regions during rainy season, affects the productivity and quality of the produce of this crop when grown under open field conditions and finally reduces the profit margin of the producers. Under
Screening of improved cultivars of cucumber in naturally ventilated polyhouse under tarai condition of Uttarakhand

MONISHA RAWAT • SK MAURYA • PK SINGH • RAM JI MAURYA

Received: Jan 16, 2014; Revised: April 12, 2014; Accepted: May 10, 2014

ABSTRACT A number of varieties/hybrids have been recently developed in the country in this crop but little effort has been made so far to screen them for their suitability of growing under poly house conditions. The experiment involving 10 genotypes includes five parthenocarpic varieties namely Hilton, Kian, Isatis, PPC-2 and PPC-3 and five monoeious F₁ hybrids namely Malini, Kamini, Sheetal, Alamgir CT-180 and NS-404, collected from different sources. All the genotypes had a wide range of variation for most of the characters under investigation. For fruit yield per hectare in rabi season, the genotypes Kian (200.15 q), Isatis (188.78 q), and Hilton (144.30 q) were the top performers and superior over the check variety PPC-3 (122.22 q), however, Sheetal was the least yielder genotype with 82.13 q/ha fruit yield and in summer season, the genotypes Malini (590.76 q), Hilton (572.80 q), and NS-404 (523.77 q) were the top performers and superior than the check variety PPC-3 (449.02 q) however, Sheetal was the least yielder genotype with 318.19 q/ha fruit yield. The high fruit yield recorded in the genotypes has been directly attributed to increased number of fruits per plant.

KEYWORDS Cucumber, Cucumis sativus L., polyhouse, parthenocarpic varieties, monoeious varieties

INTRODUCTION Cucumber (Cucumis sativus L., 2n=2x=14), an economically important member of the gourd family, Cucumber is one of the most preferred vegetables grown under protected conditions in the world. In India, it is cultivated on an area of about 39,770 hectares with annual production of about 607,160 tonnes, giving a productivity of 15.27 tonnes per ha (Anon 2012). Its demand is throughout the year because of its popular use in salad dish, sandwich, pizza preparations etc. Despite ample increase in production of vegetable crops, the low productivity in several vegetable crops including cucumber is still a challenge. Since, the land available for expansion of olericulture is limited, emphasis has to be laid on improving productivity to meet the future demands of the country and make olericulture more remunerative particularly to the small and marginal farmers. Cucumber, being a high value low volume crop, its exploitation on commercial scale in naturally ventilated polyhouse can improve productivity and generate good income to the growers. These technologies are highly suitable for the states like Uttarakhand for increasing the socio-economic status of small farmers through high profitability.

MATERIALS AND METHODS

The experiment was conducted at Precision Farming Development Centre of the College of Technology, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand – 263 145, India

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Effect of different growing media on pseudobulb production of hybrid orchid cv. Oncidium and terrestrial orchid cv. Spathoglotis

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Received: March 16, 2014; Revised: May 18, 2014; Accepted: June 5, 2014

ABSTRACT A field study was conducted at the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat with a view to find out the effect of different growing media on pseudobulb production of hybrid orchid cv. Oncidium and terrestrial orchid cv. Spathoglotis. The results of the experiment revealed that among the different treatments, growing media composed of Coconut fibre + Charcoal significantly increased the number of pseudobulb per plant (7.6) in case of Oncidium followed by Coconut fibre + Brick pieces (5.0). While in case of Spathoglotis, media composed of Loamy soil + Sand + Coconut fibre + Shredded wood produced significantly higher number of pseudobulb per plant (10.2) followed by Coconut fibre + Shreded wood (9.8).

KEYWORDS Orchid, growing media, pseudobulb

The orchids are one of the most beautiful flowers in the world. These plants belong to the family Orchidaceae having more than 25,000 species and 700-800 genera which constitutes probably the largest family among the flowering plants. Oncidium or Dancing Lady orchids are difficult to grow. This orchid with yellow flowers becoming increasingly popular in the Floriculture industry. Terrestrial orchid, Spathoglotis gains popularity because of its attractive flowers and as potential potted orchid. North East India being potentially good location for orchid cultivation, offers much scope in commercial exploitation of these orchid species.

Therefore, the present investigation was carried out to evaluate the effect of different growing media on pseudobulb production of hybrid orchid cv. Oncidium and terrestrial orchid cv. Spathoglotis.

A field experiment was carried out at the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat. The soil was sandy loam with P\textsubscript{H} of 4.90; organic carbon content 0.64 %, available N 0.07 % and available P\textsubscript{2}O\textsubscript{5} and K\textsubscript{2}O was 47.52 and 74.25 kg per ha, respectively. The experiment was laid out in randomized block design with three replications. The treatments or the different growing media used for hybrid orchid cv. Oncidium included Coconut fibre + Charcoal (T\textsubscript{1}), Coconut fibre + Brick Piece (T\textsubscript{2}), Coconut fibre + Shreded Wood (T\textsubscript{3}), Coconut fibre + Charcoal + Brick Piece (T\textsubscript{4}), Coconut fibre + Charcoal + Brick Piece + Shredded Wood (T\textsubscript{5}), Dried Leaves + Charcoal (T\textsubscript{6}), Coconut fibre + Dried Leaves (T\textsubscript{7}).

While, in case of terrestrial orchid, Spathoglotis the different growing media used were Loamy soil + Leaf mould (T\textsubscript{1}), Loamy soil + Sand + Charcoal (T\textsubscript{2}), Loamy soil + Sand + Coconut Fibre + Charcoal (T\textsubscript{3}), Loamy soil + Sand + Charcoal + Shredded wood (T\textsubscript{4}), Loamy soil + Sand + Charcoal + Shredded Wood + Brick piece (T\textsubscript{5}), Loamy soil + Sand + Charcoal + Shredded Wood + Brick piece + Charcoal (T\textsubscript{6}), Loamy soil + Sand + Brick piece (T\textsubscript{7}).

Observations were recorded on plant height, number of leaves, leaf area, days to first flower emergence, number of days to full bloom, number of flowers, self life of flowers and vase life of cut flowers. The data were analysed statistically and presented in Tables 1 and 2.

A perusal of the data (Table1) revealed that in case of Oncidium, significantly higher number of pseudobulb per plant (7.6), larger flower size (2.96), maximum flowers per spike (11.2) and longer spike length (25.2) was recorded under
Changes in physico-chemical and sensory characters of litchi fruits affected with pericarp browning

SABBU SANGEETA • CS CHOPRA

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ABSTRACT Market value of a considerable proportion of freshly harvested litchi is greatly reduced as the attractive bright red color of pericarp of freshly harvested litchi turns to unpleasant brown color within 24 or so. The arils of such low value litchi, however may have potential in the processing industry. This study was therefore undertaken to assess changes occurring in physico-chemical and sensory attributes of litchi affected with complete pericarp browning. Results indicated that slight changes were occurred in physico-chemical characteristics of litchi fruits due to development of brown color in the pericarp. Slight reductions in organoleptic profile of arils obtained from such low value litchi were, however statistically insignificant.

KEYWORDS Litchi, pericarp browning, physico-chemical composition, sensory

INTRODUCTION

Litchi (Litchi chinensis Sonn.) is a subtropical crop, non-climacteric and drupe or stone fruit. It is conical, heart shaped or spherical with a thick leathery, indehiscent pericarp at maturity. Litchi is known for its pleasant flavor and juicy pulp (aril) with attractive red color pericarp. It is also an excellent source of vitamin C and minerals. India with annual production of 580.1 thousand metric tons from an area of 82.7 thousand hectares is the second largest producer of litchi next to China (NHB 2013). Litchi fruit has great commercial potential in the domestic as well as global markets.

MATERIAL AND METHODS

Ripe fruits of litchi (Litchi chinensis Sonn.) cultivar Rose Scented used for the present study were procured from the Horticulture Research Center, Pattarchatta of GB Pant University of Agric. and Tech., Pantnagar, US Nagar (Uttarakhand) during the peak season (June). Fresh litchi fruits were kept at ambient conditions for development of brown colour of pericarp. It was observed that within 48 hours litchi fruits were completely affected with brown pericarp (Plate 1). These low value fruits as well as fresh litchi fruits were subjected to determination of physico-chemical characteristics and sensory attributes of litchi fruits affected with complete pericarp browning.

It is a very delicate fruit and highly perishable in nature. Under ambient conditions, it loses up to 7-11% weight within one day after harvest due to water losses. The attractive bright red color turns to unpleasant brown color within 24-48 hours which drastically reduces marketability of fruit. Although browning of skin may not affect the arils, it greatly reduces the commercial value of fruits in the western markets and is considered as one of the major causes of post harvest loss (Snowdon 1990). The low value litchi however, may have potential in the processing industries. Hence, the present investigation was undertaken to determine changes in the physico-chemical characteristics and sensory attributes of litchi fruits affected with complete pericarp browning.

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Estimation of protein and phenol biochemical from sporocarps of Flammulina velutips (Curt. Fr.) Sing.

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ABSTRACT Protein and Phenol were estimated from two strains (FV-1 and FV-2) of Flammulina velutips. The data revealed that the maximum protein content (27 % and 25 %) estimated in the fruit bodies of FV-1 and FV-2, respectively, followed by wheat bran + 10 % wheat bran and maize straw + 10 % wheat bran followed by saw dust + 5 % wheat bran and maize straw + 10 % wheat bran. However, the minimum protein content was estimated from the fruit bodies harvested from saw dust + 10 % wheat bran and maize straw + 10 % wheat bran in case of FV-1 and FV-2, respectively. While maximum phenol content (0.5 %) recorded in FV-1 fruit bodies harvested from wheat straw + 5 % wheat bran followed by saw dust + 5 % wheat bran. However, in case of FV-2 the maximum phenol content (0.5 %) was found in the fruit bodies harvested from maize straw + 10 % rice bran followed by wheat straw + 5 % wheat bran.

KEYWORDS Flammulina velutips, protein, phenol

Mushrooms comprise a large heterogeneous group having various shapes, sizes, colour, all quite different in characters, appearance and edibility. The term mushroom is broadly defined as “a macro-fungus with a distinctive fruiting body which can be either epigeous or hypogeous and large enough to be seen with naked eye and to be picked by hand (Chang and Miles 1992). Flammulina velutips is one of the least exploited mushroom genera in India. It is called as winter mushroom, velvet stem, Enokitake or California fungi.

Sakamoto et al. (2002) investigated protein expression patterns by two dimensional electrophoresis and 22 protein spots were found from the mycelia and fruit bodies. Badalejem et al. (2003) studied the antioxidant activity of four mycelial strains and fruiting body samples of F. velutips by peroxide oxidation of lipids assay based on processes of free radical POL in rat brain homogenate and found that the polysaccharide protein and lipid fractions showed highest activity. Fu et al. (2003) isolated an antiviral protein (Zb) from the fungus and purified it. Narai et al. (2004) isolated Flammutoxin (FTX) that is known as a hemolytic pore-forming protein. Ng et al. (2004) isolated protein designated Flamin and another protein designated as Velin were isolated from the fruiting bodies of F. velutips. Kim et al. (2008) found average total concentration of phenolic compounds was 326 mu g/g, while Lan (2008) isolated total polyphenol content of edible mushroom F. velutips.

The efforts to develop the potential of F. velutips and to increase its production for exploiting its medicinal efficiency are still in developing stage in India. In the present...
GUIDELINES FOR AUTHORS

Journal of Hill Agriculture (JHA) is an international journal and an official publication of Indian Society of Hill Agriculture (ISHA). It publishes the original research in all branches of agriculture and allied science (as mentioned below) that is of primary interest to the agricultural development, especially in hill and mountain regions of the world. The publication is open to the members of Indian Society of Hill Agriculture but it also accepts papers from non-members if all authors become the annual/life member when a paper is submitted / accepted for publication. The journal publishes four types of articles, i.e. (i) Strategy / Policy paper (exclusively by invitation from the personalities of eminence), (ii) Review papers (full and short), (iii) Research papers and (iv) Short communications. The manuscripts should be submitted to the Editor-in-Chief (JHA) by e-mail as attached file saved in MS Word to editorinchiefjha@gmail.com or by online submission on our website www.ishaindia.in or through indianjournals.com. The status of manuscripts can also be checked online. Each manuscript must be typed doubled spaced on one side of an A4 size page. Clearness, brevity and conciseness are essential in form, style, punctuation, spelling and use of English language. Manuscripts should conform to the SI system for numerical data and data should be subjected to appropriate statistical analysis. On receipt of an article at the Editorial Office, an acknowledgement giving the manuscript number is sent to the corresponding author. This number should be quoted while making any future enquiry about its status.

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### Abbreviations for citing references

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