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Application of nanotechnology in food - a review

KANIKA ISSAR • ANIL GUPTA

Received: Mar 11, 2011; Revised: Aug 12, 2011; Accepted: Aug 25, 2011

ABSTRACT Nanotechnology is the engineering of functional systems at the molecular scale. This covers both current work and concepts that are more advanced. It refers to the projected ability to construct items from the bottom up, using techniques and tools being developed today to make complete high performance products. Nanotechnology is generally regarded as new approaches to manipulation of materials and structures. This new type of material science will impact on the food industry. The electronics industry already uses nanotechnology and there are likely to be continued advances in the miniaturisation of computer chips and enhanced data storage, which will undoubtedly lead to improvements in food safety and authentication. Nanotechnology can be applied in all aspects of the food chain, both for improving food safety and quality control and as novel food ingredients or additives, which may lead to unforeseen health risks. There are some concerns about implementation guidelines and risk assessment methods. The general public lacks awareness of nanotechnology in general, and applications of nanotechnology in food in particular.

KEYWORDS Nanotechnology, food, material science, food safety, nanomaterials

INTRODUCTION

Nanotechnology is the high technology, atomically processed antithesis to organic agriculture, which values the natural health-giving properties of fresh, unprocessed whole foods. It also introduces serious new risks for human health and the environment. Nanotechnology is a powerful new technology for taking apart and reconstructing nature at the atomic and molecular level. Nanotechnology and nanoscience involve the study of phenomena and materials, and the manipulation of structures, devices and systems that exist at the nanoscale, <100 nanometres (nm) in size. The novel properties of nanomaterials offer many new opportunities for the food and agricultural 35 industries, for example as more potent food colourings, flavourings and nutritional additives, antibacterial ingredients for food packaging and more potent agrochemicals and fertilizers. Nanotechnology to biotechnology (nano-biotechnology) is predicted not only to manipulate the genetic material of humans, animals and agricultural plants, but also incorporate synthetic materials into biological structures and vice versa (Roco and Bainbridge 2002). Nanotechnology can make products cost effective (production will be carried out by self-replicating nano devices using small amount of material, energy, low capital, less labour and land), production being more efficient, decreased use of water and minimum wastage (Chaudhary et al. 2006). However, there is a need for risk assessment and means to control the same in order to reap the benefits. Nanotechnology has the potential to revolutionize the scientific world by allowing scientists to manipulate matter at the atomic or molecular scale using physics, engineering, chemistry and biology (Roco et al. 1999). It enables researchers to understand the relationship between macroscopic properties and molecular structure in biological materials of plants and animal origin (Kullzer and Orrit 2004). Using nanotechnology, scientists are able to self assemble atoms into structures with highly controlled properties e.g. nanowires (Huang et al. 2001, Houssain et al. 2005), self assembled molecules and particles (Dutta and Hoffman 2004), 3-D architecture (Vayssieres 2001) etc. The concept of self-assembly with nanotechnology has the potential to impact diverse fields ranging from biology to materials science (Liu et al. 2003). The term ‘nanofood’ describes food which has been cultivated,
Pan evaporation under arid climatic conditions of Qena, Egypt

AA HASSAN • SM EL SHAZLY • KH O KASSEM • AK MAHMOUD

Received: Jun 16, 2011; Revised: Nov 10, 2011; Accepted: Dec 10, 2011

ABSTRACT The effect of meteorological variables such as ambient air temperature, relative humidity, solar radiation, wind velocity, and vapor pressure deficit on the rate of pan evaporation was examined at different time scales using 5 years (2001-2005) meteorological data at Qena, Upper Egypt. The examination was made at daily, 10-day, monthly and seasonally time scales. An empirical formula has been deduced concerning the interrelation of meteorological variables with pan evaporation rate. Correlation and simple linear regression analysis were used to observe the influence of individual meteorological variables on pan evaporation rate. Vapor pressure deficit was the most influencing parameter on pan evaporation rate, which affected positively. The ambient temperature and solar radiation, also, have a significant role on evaporation rate, indicating the positive relation while, the wind speed has a less effect. On the other hand, relative humidity has a negative effect. Good agreement between measured and calculated values of pan evaporation rate has been found. It gives us an impression that the derived formula is successful and useful to calculate the evaporation rate in our location.

KEYWORDS Pan evaporation, meteorological variables, correlation coefficient, linear regression.

INTRODUCTION

The rapid increase in both world population and consumption of water due to the rising standard of living and levels of economic activity have greatly intensively the demand of water all over the world. This is leading to the necessity to manage all the available water. The study of characteristic of evaporation from water surface is considered a first step of water management.

Evaporation of water in the natural environment is one of the main faces of the hydrological cycle. In the hydrological cycle, water is transferred to the atmosphere from the earth’s surface by precipitation and returned to the atmosphere by evaporation. Water in the vapor phase is generally unavailable for human use therefore, there is a need for adequate knowledge and understanding of the parameters and the processes that contribute the evaporation.

Factors affecting the rate of evaporation from any body of surface can be broadly divided into two groups: meteorological factors and surface factors. The meteorological factors may be divided into energy and aerodynamic variables. Energy is needed to change water from the liquid to the vapor phase, in nature, this is largely supplied by solar and terrestrial radiation. Aerodynamic variables include wind speed at the surface and vapor pressure difference between the water surface and the lower atmosphere (vapor pressure deficit VPD). Influence of meteorological parameters on the pan-evaporation rate has been studied by many authors (Devenport 1967, Singh et al. 1981, Singh et al. 1992, Khan 1992, Sahu et al. 1994, Alshaiikh 1998, Khanikar and Nath 1998, Xu and Singh 1998, Shrivastava et al. 2000, Holterman 2003).

There are many ways of measuring evaporation rate. One of the most common methods is US class A pan (Allen et al. 1998). Evaporation direct measurement techniques are not recommended for hydrologic engineering applications because they imply a time consuming procedure, requiring expensive equipments in order to obtain precise and carefully designed experiments. Therefore, evaporation estimation methods based on climatic data are very common. Such methods vary from simple empirical formulation to complex methods. The present paper focuses on studying the
Physico-chemical characters of different cultivars of pear affected by bio-regulators during storage

BL Attri • Hare Krishna • Naeer Ahmed • Akhilesh Kumar

Received: Aug 9, 2011; Revised: Nov 3, 2011; Accepted: Dec 10, 2011

ABSTRACT To enhance the shelf life of the fruit for extending its availability in the market, a study was carried out on the effect of bio-regulators viz., salicylic acid and Ca-EDTA on different cultivars of pear like Sand pear, Jagnier, Kashmiri, Kakria and Olympia. The selected fruits of different cultivars of pear were dipped for 30 minutes in salicylic acid @ 200 ppm, Ca-EDTA @ 0.4 % ppm and control (distilled water dip). The treated fruits were stored in CFB boxes at ambient temperature (18-20 °C) for 30 days. During storage, the effect of bio-regulators on various physico-chemical characteristics such as TSS, acidity, ascorbic acid, sugars and antioxidants of pear fruits were studied at 10 days interval. It was found that the fruits treated with bio-regulators had significantly better firmness retention and low PLW (8.37, 10.24, 12.34, 2.29, 5.73 %) during storage for 30 days as compared to control (11.10, 14.08, 15.95, 5.46, 11.32 %). The TSS, acidity, ascorbic acid, sugars and antioxidant contents in these treatments remained checked, whereas in untreated fruits the conversion rate was faster. During storage, salicylic acid and Ca-EDTA slowed down respiration rate resulting better shelf life. The treated fruits irrespective of cultivars had a shelf life of 30 days as compared to 20 days in control. The study concluded that the shelf life of the pear fruits could be increased with better physico-chemical characteristics using bio-regulators like salicylic acid and Ca-EDTA.

KEYWORDS Pear cultivars, salicylic acid, Ca-EDTA, physico-chemical characters, storage

INTRODUCTION

The north-west Himalayan states viz. Jammu and Kashmir, Himachal Pradesh and Uttarakhand have hilly terrains, valleys and high mountains which are the habitat for a number of temperate fruits. Uttarakhand is very rich in the bio-diversity because of congenial climatic and geographic conditions which is also suitable for cultivating a number of fruits viz., apple, pear, peach, plum, apricot, walnut etc. Pear (Pyrus sp.) is the second largest cultivated fruit in the region after apple (Anon 2009). It is being cultivated both in hilly and mountainous region like Jammu and Kashmir, Himachal Pradesh, Uttarakhand and north-eastern states whereas some of cultivars are grown in lower hills, valleys and plains of adjoining states such as Punjab and Haryana. Due to hardy nature of the plant it thrives well under adverse climatic conditions and yield is very high giving good returns. Besides local consumption, the fruit is preferred in distant markets due to the crisp texture and pleasant flavour. However, due to poor postharvest and transport facilities available in the hilly regions, the fruit do not reach distant market in good condition, thus resulting in high post harvest losses (Mahajan et al. 2004). The costly and improved techniques such as controlled atmospheric storage and modified atmosphere packaging are used in developed countries to check these losses. Under Indian conditions, simple and inexpensive techniques such as post harvest chemical treatments offer better prospects for reducing the postharvest losses of fruits (Randhawa et al. 1980). In Uttarakhand a number of pear cultivars are found growing which include Sand pear, Jagnier, Kashmiri, Kakria and Olympia. Few of them like Sand pear and Kakria had a better shelf life because of hardy fruit skin whereas others lack in post

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Inheritance of qualitative characters from male sterile hot-pepper into male fertile bell-pepper (*Capsicum annuum* L.)

AK JOSHI • AMBREEN NABI • SHIV PRATAP • K KUMAR • RK GUPTA

Received: Jul 26, 2011; Revised: Aug 25, 2011; Accepted: Dec 10, 2011

**ABSTRACT** Chilli and bell pepper (*Capsicum annuum* L.) popularly known as ‘Lal Mirch’ and ‘Shimla Mirch’, respectively are important solanaceous crops grown throughout the world. The study was carried out at the main farms of the university by crossing hot-pepper male sterile genotypes, DKC-12A and DKC-12ms, with male fertile varieties of bell pepper i.e California Wonder and HC-201. *F*1’s were produced during 2007, *F*2’s and backcrosses during 2008. The whole material was evaluated during 2009. The experiment was laid out in compact family block design where the crosses were considered as families and generations within crosses as progenies and replicated thrice. Qualitative characters were subjected to Mendelian ratios and goodness of fit was tested by chi-square test. The dominance of pendent over upright bearing habit was found to be governed by a single dominant gene. Similarly, the chilli type fruit shape was partially dominant over the bell shape. Male sterility was found to be monogenic recessive. The anther colour revealed the dominance of grayish purple anther colour over dark blue colour and controlled by single gene. The dark blue anther colour was associated with male sterility.

**KEYWORDS** Male sterility, hot-pepper, bell-pepper, monogenic, anther colour, bearing habit

**INTRODUCTION** Hot-pepper and bell pepper popularly known as ‘Lal Mirch’ and ‘Shimla Mirch’, respectively are important solanaceous crops grown throughout the world. Both bell (sweet) and hot peppers originated from *Capsicum annuum* L. The hot pepper or chilli is *Capsicum annuum* var. *acuminatum* L., whereas bell pepper or green pepper is *Capsicum annuum* var. *grosorum* L. (Hundal and Dhall 2004). All the cultivated as well as wild species are diploid (2n=24). The genus *Capsicum* includes many cultivated forms such as pungent pepper used as spice, mild pepper as salad and pickles, bell shaped (non pungent) used for salad, stuffing, pickling, processing and culinary purposes. All being cross compatible, hence, allows the free exchange of gene(s) from one form into another.

Bell pepper fruits are available in the market year around with different shapes and colours. With increase in demand, the emphasis is being given to the development of hybrids. In India, bell-pepper productivity is 9.23 t/ha whereas chilli productivity is 1.24 t/ha (FAO 2009). These figures are alarmingly lesser to world average. Hybrid varieties are successfully ameliorating the productivity issue. Such cultivars released by the private firms have proved boon to the farmers, but exorbitant cost of the hybrid seed coupled with enhanced input supply are the major hurdles to the farmers. The public sector hybrids could not reach the farmers, in masses, due to laborious seed production methods which are based upon hand emasculation and hand pollination.

Male sterility and self incompatibility have proved useful tools in economic hybrid seed production of vegetable crops (Joshi et al. 2000). Genetic and cytoplasmic male sterility are used on a limited scale for hybrid seed production in bell pepper (Joshi and...
Oxidative amperometric reverse phase HPLC determination of bifenazate (Floramite 50WS) residue in scented rose (Rosa bourboniana Desp.)

AJAY KUMAR • SANJIVAN BAHMAN • ADARSH SHANKER • GIREESH NADDA

Received: Oct 05, 2010; Revised: Dec 3, 2011; Accepted: Dec 10, 2011

ABSTRACT The method for detection and determination of bifenazate residue and percent transfer to rose water in Scented Rose, Rosa bourboniana Desp. was studied. The acricide: Floramite 50WS (bifenazate-D2341, C_{17}H_{15}N_{2}O_{4}) was quantified by reverse phase HPLC. LaChrom-Merck equipped with L-5500A oxidative electrochemical detector and Lichrospher100 (C18) 250-4 end capped (5 μm) column. Mobile phase, 55:45 v/v (5 % acetonitrile/ 95 % sodium acetate buffer 50 mM, pH 4): (acetonitrile + 0.5 % acetic acid) was pumped at 1 ml/min. HPLC oven was set at 60°C and detector at working potential of +0.40 V, noise filter 60 dB/OCT, time constant 5 sec and range out +10 nA. Calibration from serial dilutions of 1 mg/L working solution showed good linearity (r 2 0.99) and LOD (0.10 mg/L). Good recoveries in leaf, flower, rose water and soil (94-67-107.9 %) were achieved. In field, the acricide persisted for about 30 days on leaves, while in the soil, it persisted for 15 days only. Residue persisted in flowers only, up to the 7th day and was below detection limit by the 15th day. Half life (single dose) was calculated to be 5.23 days on the leaves.

KEYWORDS Amperometric, bifenazate, floramite, scented rose, Rosa bourboniana, residue

INTRODUCTION

Rose is one of the most important crops for floriculture industry. The genus Rosa includes 200 species and 18000 cultivars (Goud 2000). Roses also have an economic importance for their essential oils as a source of natural fragrances and flavorings. There are mainly four species of roses, R. damascena Mill., R. gallica L., R. moschata Herm., and R. centifolia L. (Tucker and Maddrell 1988). R. damascena (Damask rose, pink rose) and R. bourboniana (Bourbon rose) are among the important commercial aromatic and medicinal plants cultivated in India. The former produces flowers for 25 to 35 days once in a year during early summer, while the latter flowers three times in a year. These species yield valuable products like rose oil, rose water, concrete, absolute, dry petals and are also used in traditional medicines and teas. Rose water is used in dermal and ophthalmic diseases. In India, scented rose is cultivated in the states of Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, Rajasthan and Bihar producing about 150 kg rose oil besides making major quantity of rose water and a small quantity of blended rose oil called attars. In the world scenario, Turkey and Bulgaria are the leading countries in the production of rose oil while Morocco produces mainly rose water. During the past 15 years, Turkey has become an important producer of rose oil and concrete (Gamer et al. 1976). Egypt, China, France, New Zealand and Russia are among other countries which also produce rose products (Margina et al. 1999).

Scented rose is attacked by several insect pests causing economical losses. Aphids, thrips, rose midge, chaffers, beetles, red scale, mites, termites, caterpillars, leaf hoppers, leaf rollers, borers and saw flies are common pests of scented rose (Kumar et al. 2004).
Inhibition of seed germination and seedling vigour by walnut leaf extracts in two varieties of lentil (*Lens culinaris* Medik)

BIREN德拉 PRASAD • S K LAVANIA • V K SAH

ABSTRACT Inhibition of seed germination and seedling vigour of two lentil (*Lens culinaris* Medik) varieties (cv. VL 125 and VL 507) recommended for hills under West Himalayan agri-silvi system assessed by Walnut leaf extracts concentrations. Six treatments comprised of distilled water (Control 20 %), 40 %, 60 %, 80 % and 100 % concentration of leaf extracts were used. The effect of aqueous extract was found inhibitive indicating a direct proportional relationship with concentration dependent manner on seed germination and subsequent seedling vigour parameters. Both varieties exhibited maximum extent of inhibition at 100 % extracts application in comparison to other lower concentrations along with untreated control. Invariably there was a decrease in germination at first count and final count, length of root, shoot and seedling, seedling fresh and dry weight, vigour index (I and II) and relative growth index (RGI) with increasing aqueous extracts concentration on germinating lentil. However, the shoot length was observed maximum at 20 % concentration for variety VL 125, while fresh weight of cotyledons increased as the concentration increased in both lentil varieties. It was found that seed germination and seedling vigour were influenced negatively by walnut leaf extracts in concentration dependent manner and maximum values were obtained for control and minimum for 100 % treatment. Out of two varieties of lentil, VL 125 showed more tolerance than VL 507 against walnut leaf extracts.

KEYWORDS Inhibition, seed germination, seedling vigour, lentil, walnut leaf extract

INTRODUCTION

Walnut (*Juglans regia* L.) is a large deciduous fruit tree with long fragrant leaves, distributed in the Himalayas between 1375-3350 m amsl, extending in the west to Afghanistan and east to Bhutan. In the Himalayas, walnut is one of the first species to shed its leaves and tree becomes leafless from September-October i.e. the right time of Rabi crop sowing in hills. In North-West Himalayan region of India tree based intercropping has been in practice since ages and walnut is one of the most common trees species of horticulture based agro-forestry systems. This tree species have phytotoxic effects on certain plants and toxic principle of leaf extract is Juglone (5-OH-1, 4 naphthoquinone), an allelo-chemicals which is present in leaves, hulls and inner root bark. The effects of these chemicals on other plants are known as allelopathy to be dependent on the concentration released into the soil/environment. Allelopathy involves a plant’s secretion of biochemical materials into the environment to inhibit germination or growth of surrounding vegetation. Allelopathic effect of trees on agricultural crops are well documented (Kohli et al. 2002, Tripathi et al. 1996). Lentil (*Lens culinaris* Medik) commonly known as Masoor is an important *Rabi* pulse and constitute a major source of protein in the predominantly vegetarian diets of Indian people. Beside these they maintain soil fertility through biological nitrogen fixation in association with symbiotic rhizobia prevalent in their root nodules and thus play a vital role in furthering sustainable agriculture. Lentil is one of the major *Rabi* pulse crop sown as a companion crop with the walnut tree in agri-silvi system. Inhibition in seed germination, subsequent seedling vigour, poor growth, development
Nature of acidity in some soils of Sikkim

S Sasmal • SK Pal

ABSTRACT  Forty-ﬁve surface soil samples for three soil acidity groups, namely (i) strongly acidic soil (pH < 5.0) - Group A, (ii) moderately acidic soil (pH 5.0 - 5.5) - Group B and (iii) mildly acidic (pH 5.6 - 6.5) - Group C were collected from farmers’ ﬁeld of south Sikkim district of Sikkim state to study the nature of the acidity and their relationship with physical and chemical properties as well as lime requirement. Electrostatically bound H+ contributed 50 to 70% of exchange acidity for three soil groups. Electrostatically bound H+, extractable acidity and pH dependent acidity were the highest in soils of strongly acidic soil group (Group A), while other forms of acidity were maximum in soils of moderately acidic soil group (Group B). pH dependent acidity constituted 85.3%, 81.8% and 75.8% of total potential acidity, while hydrolytic acidity constituted 71.6%, 74.8% and 62.7% of total acidity for the soils of group A, B, C, respectively. Different forms of acidity were signiﬁcantly related among themselves as well as with physical and chemical properties like pH, silt, clay, exchange Al and extractable Al content. Among the soil properties variation in the amount of exchange Al and extractable Al, pH, and organic carbon were responsible for the variation in different forms of soil acidity. Lime requirement values were mostly inﬂuenced by pH and organic carbon content of the soils.

KEYWORDS  Soil acidity, soils of Sikkim, soil properties

INTRODUCTION  Sikkim has a wide range of climate, physiography, geology and vegetation that inﬂuence the formation of diﬀerent kinds of soil. High rainfall coupled with loss of both alkali and alkaline earth metal ions through leaching with simultaneous accumulation of iron and aluminium hydroxyl compounds causes the soil acidity (Panda and Chauhan 2002). Soil acidity and related soil factors together affect the agricultural crop production to a great extent indicating that cultivation in such soils (acid soils) is less remunerative until and unless the appropriate soil management strategies are to be adopted.

Soil acidity can be grouped into three categories namely active acidity, exchange acidity and reserve acidity. Active acidity develops due to the presence of H+ and Al3+ ions in the soil solution, while exchange acidity develops due to adsorbed H+ and Al3+ ions on the soil colloids. Aluminium hydroxyl ions and hydrogen and aluminium ions present in non-exchangeable form with organic matter and clays account for the potential acidity. The total acidity is the summation of active and exchangeable acidity. Chand and Mandal (2000) pointed the soil acidity in terms of KCl extractable and pH dependent acidity. The ﬁrst type of acidity is due to isomorphous substitution, while the second type is due to the polymers of iron and aluminium ions and organic matter.

Management of acid soils needs to identify the extent and severity of the problem. The rate of lime required depends on the extent of pH change necessary, and buffering capacity of the soil. In this backdrop the present investigation was undertaken with a view to characterize the nature of soil acidity and determination of lime requirement for the soils of Sikkim.

MATERIALS AND METHODS  Soil samples for the present study were collected from the surface layer (0 – 0.15 m depth) farmers’ ﬁeld in south Sikkim district of Sikkim State.
Assessment of soil fertility for crop planning in flood affected areas of Dhemaji district of Assam

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Received: Feb 05, 2011; Revised: Sep 05, 2011; Accepted: Dec 10, 2011

ABSTRACT Frequent flash floods have converted highly productive agricultural lands of Dhemaji district of Assam into sand/silt laden uncultivable lands. An investigation was carried out in Lalong, Samarajan and Dalhalgaon village of Dhemaji district to assess the soil fertility for crop planning. After delineating the sand/silt deposited areas, soil samples were collected from representative sites. Physico-chemical properties of the soil samples were estimated. The study showed that the damage was caused by rivers Gamadi and Jiadhal which affected 516 ha areas out of the total geographical area of 1047 ha. The affected soils were found low in fertility and moisture retention. The texture varied from sands to sandy loamy sand. Bulk density was high, organic carbon content was low and pH was almost neutral. The climatic parameters showed that the length of growing period was more than 300 days. Soil management activities and short term land use planning was suggested for the affected areas. In the areas where sand deposition is < 30 cm, a deep ploughing with tractor drawn MB plough is suggested for increasing the infiltration of water and penetration of roots and green manuring for increasing the organic matter content. In the areas with > 30 cm sand deposition, deep rooted crops like arecanut, coconut and arhar are suggested. Crops like watermelon, muskmelon, pumpkin, pointed gourd etc. may be suggested to grow in pits and areas with < 15 cm sand for normal cropping after a deep ploughing. Oilseed crops like rapeseed and mustard, niger, castor and groundnut are suggested for areas with < 15 cm sand deposition.

KEYWORDS Sand deposited areas, Dhemaji, soil fertility, Samarajan, flood

INTRODUCTION Dhemaji district in North Bank Plain Zone of Assam faces annual floods and is worst affected in terms of frequency and duration of flood every year. After the recession of floodwater, it is being noticed that a thick layer of sediments, mostly sand, gets deposited over a large area which is adversely affecting cultivation of crops and habitation as well.

Interpretation of remote sensing data, toposheets and ground truth checking showed that the district was severely affected by sand/silt deposition from the river Brahmaputra and its tributaries viz., Jiadhal, Sisi, Gamadi, Moridhol, Gutung, Dihing etc. An area of about 14,879 ha (Planimeter calculated) was under sand cover. The affected area constitute about 5% of the total geographical area and about 15% of the total cultivated area of the district (Vedivelu et al. 2001). At present, the immediate need is to get an alternate land use proposition, to improve the agriculture system for livelihood of the people of the affected areas. Considering the importance the present investigation was done for planning of cropping system in the sand deposited areas.

MATERIALS AND METHODS

Based on the sand/silt deposited map of Dhemaji district of Assam prepared by NBSS and LUP, NE Regional Centre, Jorhat in 1999, three villages namely Lalong, Samarajan and Dalhalgaon were selected for the investigation. The villages were selected in such a way that they represent the whole sand/silt deposited areas of the district.

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Economic benefits of Vivek millet thresher-cum-peerler and agro processing centre in hilly region of Uttarakhand

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RESEARCH PAPER

Received: Feb. 06, 2011; Revised: Jun 09, 2011; Accepted: Aug 25, 2011

ABSTRACT Agriculture is dominant activity in the hill economy but constrained by poor post harvest infrastructure and non availability of post harvest technology, which make this profession non-profitable venture. In this backdrop, AICRP on PHT, VAPKAS Almora centre has developed Vivek Millet Thresher-cum-Pearler and also established Agro Processing Centre (APC) in village Takula (Uttarakhand) for entrepreneurship development. This paper has examined the economic impact of these interventions. Vivek thresher-cum-pearler with 60 kg/h capacity of pearling of finger millet, dehulling of barnyard millets (5 kg/h) and threshing of millets (40-45 kg/h) was found suitable for hilly region, as the machine is lightweight and can be operated with engine as well as electric motor (1hp). The benefits were realized in terms of reduction of post harvest losses (threshing 2-3% and dehulling 10-12%), and labour cost (Rs 50/q) over conventional practices. Nevertheless, it helps in reduction of drudgery, saving of time and energy, and improvement in storage life. The net profit per machine was found Rs 13530 for one season (50 days). Consequently, the estimated total monetary gain was found to the tune of Rs 74.42 lakh per annum to farmers cum entrepreneurs and Rs 11.26 lakh to consumers/society. Further, APC was found economically viable enterprise as average net income (triennium ending 2008) was found to the tune of Rs 1.65 lakh per annum with benefit cost ratio (BCR) of 1.24. Further APC helped in avoiding distress sale and value addition to farm produce and also established forward and backward linkages.

KEYWORDS Vivek miller cum thresher, agro processing centre, benefit cost ratio, marketing

INTRODUCTION

Agriculture is the main activity in the hill region but its potential in terms of reviving rural economy is still to be explored. Various factors such as socio economic status, poor infrastructure (pre and post harvest), and poor marketing and networks (lack of market development) have led to underutilization of resource base in hills and does not allow to take full market advantage of off seasonal produce (Dixit and Sharma 2010, Partap 2011). Besides, least attention was given in the past towards development of proven post harvest technology and establishing processing facilities in production catchment itself. Dixit et al. (2010) summarized that post harvest technology in hilly region has implications for entrepreneurship development, whereas, Srinivas et al. (2009) realized that Agro Processing Centre (APC) establishes forward and backward linkage which ensuing to adoption of new variety and modern agro techniques for enhancing yield, marketable surplus and income of the intended beneficiaries. Further, the impact of agro industry on rural development establishes credible effect at both personal and community level (Oladipo 2008). The innovation and technology has divergent economic impact, i.e localized as well as pervasive (Sotte and Verspagen 1993).

Millets are major food sources in arid and semi-arid regions of the world and India is the largest producer (8.8 lakh tonnes) and consumer (42 % of total world production) of millets (FAO 2010). Millets (finger and barnyard millet) are the staple food grain in North Western Himalaya of India and also

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Seasonal incidence of blister beetles (*Mylabris* spp.) on okra in Himachal Pradesh

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Received: Jul 14, 2011; Revised: Nov 12, 2011; Accepted: Dec 10, 2011

ABSTRACT Field experiments were conducted to study the seasonal incidence of blister beetle, *Mylabris* spp. on okra at two locations in mid hills of Himachal Pradesh. The results showed that at Palampur, *Mylabris* spp were active on okra crop from last week of July to last week of September and at Kachhiari were active from first week of July to first week of September during the two seasons. Peak blister beetle population and flower damage were observed in third week of August to first week of September at Palampur and second to third week of August at Kachhiari when the mean meteorological conditions of 27.7-29.1°C (max temp), 20.2-25.8°C (min temp), 75-79% (RH), 7.1-7.9 hr (BSS) and 37.8-80.5 mm total rainfall were prevalent at the two locations. Thereafter, the beetle population and its damage began to decline as the crop approached last phase of growth. The beetle population and flower damage were significantly and positively correlated with maximum temperature and bright sunshine hours while significantly and negatively correlated with minimum temperature and relative humidity.

KEYWORDS Blister beetle, *Mylabris* spp., okra, seasonal incidence

INTRODUCTION

One of the major reasons for low yield of okra crop in Himachal Pradesh is the extensive damage to crop due to leafhopper, *Anrasca biguttula biguttula* (Ishida), shoot and fruit borer, *Earias vittella* (Fabricius), *E. insulana* (Bousquet) and whitely transmitted yellow vein mosaic disease during *kharif* season (Prasad et al. 1993, Mandal et al. 2006). Besides, in recent years, blister beetles, *Mylabris* spp. that were earlier referred to as minor pest of okra (Nair 1984) have been observed to cause substantial damage to the crop in Himachal Pradesh especially in mid hills (Badiyala, 2010). The nymphs and adult beetles feed on floral parts of okra plants causing reduction in flowering and eventually the fruit yield of the crop (Barwal and Rao 1988). In developing an ecological sound pest management programme, it is imperative to study the seasonal incidence of a pest. This information not only helps in initiating control measures at appropriate time but is equally important for judicious use of insecticides. Keeping in view that little information is available on the seasonal incidence of blister beetles, *Mylabris* spp. on okra in Himachal Pradesh and rest of the country, the present investigation was carried out.

MATERIALS AND METHODS

Present study was carried out during 2005 and 2006 crop seasons at two locations in mid hills of Himachal Pradesh viz. research farm of Department of Entomology, Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh - 176 062, India

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Micro-organisms associated with developmental stages of honeybees, *Apis cerana* F. and *Apis mellifera* L.

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Received: Aug 18, 2010; Revised: Dec 21, 2010; Accepted: Jul 10, 2011

**ABSTRACT** Honeybee, *Apis cerana* F. and *Apis mellifera* L. colonies were screened to segregate mite (*Tropilaelaps clareae*) infested and healthy colonies. A group of three experimental colonies each in the case of infested and healthy honeybees were maintained 20 m apart with 3 m inter colony distance. Samples of life stages at egg, larva and pupa were drawn at age 0, 6 and 16 day respectively of brood development and adult bees of more than 5 day age were investigated for the species composition of microflora. Nutrient agar medium (NA) and potato dextrose agar (PDA) were used as primary culture media for isolating bacteria and fungi. Results revealed fungi in 55-60 % larvae and 8-10 % adult bees and bacteria in 100 % adults, 8-10 % larvae and 4 -5 % pupae in both the species of honey bees infested with *T. clareae*. Eggs did not indicate the presence of microorganisms. The microflora of larval and pupal stages in the mite infested colonies was higher and most varied as compared to the healthy colonies indicating that *T. clareae* infestation affects the composition of associated microorganisms.

**KEYWORDS** Honeybees, micro-organisms, fungi, bacteria, *T. clareae* infestation

**INTRODUCTION**

The honeybee is known for maintaining hygiene in its colony. However, evidence is accumulating with respect to infestation of honeybee brood by parasitic mites and microorganisms (Dejong et al. 1982). Studies by Drobnikova (1987) showed that facultative microorganisms become extra ordinarily pathogenic on *A. mellifera* brood parasitized by *Varroa jacobsoni*. Ball (1988) demonstrated *V. jacobsoni* as a vector of acute paralysis virus of honeybees. Bailey (1981) found three times as many bacteria in *A. mellifera* bees infested with *Acarapis woodi*. Kumar et al. (1994) showed the association between *T. clareae* and microorganisms in *A. mellifera*. With this background the present studies were undertaken to reveal the microorganisms harboured in the developing brood, pollen cells and adults of *A. cerana* and *A. mellifera* bees with or without *T. clareae* infestation.

**MATERIALS AND METHODS**

Honeybee, *A. cerana* and *A. mellifera* colonies were screened for parasitic infestation by mites and microorganisms. A group of three colonies each of *A. cerana* and *A. mellifera* with brood infestation by *T. clareae* was segregated and maintained at about 20 m away from the main stock. Another set of three colonies where brood and debris were found to be free from mite infestation was likewise segregated and placed 20 m away from the main stock in different directions. Inter colony distance of 3m was maintained to avoid contamination of these colonies by way of drifting honeybees.

Samples of developing brood at age 0 day the egg stage, 6 day the larval stage, 16 day the pupal stage and the adult worker of more than 5 day age were randomly collected from the marked combs in brood nest separately from *A. cerana* and *A. mellifera* mite infested and healthy colonies. The samples were processed as given below. Three drops of sterile distilled water were put with the help of a clean dropper in the comb cell containing honeybee egg at 0 day stage. There after
Effect of physico-chemical characteristics on nutrient availability in cherry orchard soils of Kashmir

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Received: Feb 10, 2011; Revised: June 25, 2011; Accepted: Jul 10, 2011

ABSTRACT A study was conducted in cherry orchard soils to find out the effect of physico-chemical characteristics on nutrient availability and for this 12 soil profiles were excavated. It was observed that pH was slightly acidic to slightly alkaline, while as, electrical conductivity and calcium carbonate was normal. The organic carbon content was high. The soils were adequate in available nitrogen, phosphorus and sulphur, while as, they were high in available potassium, exchangeable calcium and magnesium and DTPA extractable copper, iron and manganese, however, they were low to high in available zinc. The physico-chemical characteristics of soil exhibited significant effect on the availability of nutrients.

KEYWORDS Physico-chemical characteristic, nutrients, soils, cherry

INTRODUCTION

Fruit production is an important industry contributing a great deal to the economy of state. Different deciduous fruits are grown in valley owing to diverse agro-climatic conditions. The valley of Kashmir is famous for the production of temperate fruits and nuts and leads in the production of apple, pear, cherry, walnuts, almonds etc. The area under fruits in Jammu and Kashmir is 2.95 lakh hectares and produces 16.36 lakh metric tonnes of fruits. Under cherry fruit the area in Kashmir valley is 3.11 thousand hectares producing 10.6 thousand metric tonnes of cherry (Anon 2008). Nutritional survey is important to know the general fertility status of soils and is a pre-requisite for any crop research and developmental programme. The nutritional status and physico-chemical characteristics of soils differ from place to place, which may be due to variation in climate, altitude, mineralogical composition, aspect, organic matter and various other factors. The availability of nutrients in soils is affected by the physico-chemical characteristics of the soils to a great extent. For example pH of the soil affect the availability of nutrients. When pH is above 8.0, calcium becomes dominant and suppresses the availability of other nutrients like potassium and micro-nutrient cations. Similarly organic matter and clay content in higher amounts improves the availability of various nutrients in soils as they have higher CEC and also due to the acidulating action of organic matter. Soil tests are of significance value in estimating nutrient availability to plants and also determine the effect of different physico-chemical characteristics on availability of nutrients. In cherry orchard soils, no study has been made so far to know the effect of physico-chemical characteristics on nutrient availability. Therefore, present study has been undertaken to evaluate the effect of physico-chemical properties on nutrient availability with respect to cherry orchard soils of Kashmir.

MATERIALS AND METHODS

Twelve cherry orchards were selected and from each orchard, soil samples were collected from different soil depths viz., 0-20, 20-40, 40-60 and 60-80 cm. The soil samples were air dried, crushed, sieved and stored in polythene bags for analysis. A portion of each sample was sieved through 0.5 mm sieve for the estimation of organic carbon. Soil pH and EC were measured in 1:2.5 soil water suspension. Organic carbon was determined by wet digestion method outlined by Walkley and Black (1934). CaCO₃ was estimated by rapid titration method.
Identification and development of genic male sterile line in chilli
(Capsicum annuum L.)

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Received: Feb 16, 2011; Revised: Mar 06, 2011; Accepted: Jul 10, 2011

ABSTRACT A male sterile plant named DKC-2363, in the population of chilli line DKC-5 was detected in 2005 at Horticultural Regional Research Station Dhaulakuan (HP). To reproduce the plant progeny, this plant was crossed with seven other male fertile plants of the same population. The F1 population of six crosses produced fertile progeny while the population of a cross named DKC-2363 x P4 segregated into 1:1 ratio of fertile: sterile plants, consecutively for five years. Such inheritance indicates the presence of genic male sterility controlled by single recessive gene.

KEYWORDS Capsicum annuum L., spontaneous mutant, genic male sterility, single recessive gene.

In India, bell-pepper productivity is 9.23 t/ha whereas chilli productivity is 1.24 t/ha (FAO 2009). Hybrid varieties are successfully ameliorating the productivity of capsicums. The glaring example had been the development of two chilli hybrids viz. CH-1 and CH-3 (Hundal and Khurana, 1993, 2001) by the scientists at Punjab Agricultural University, Ludhiana. Such cultivars released by the private firms have proved boon to the farmers, but exorbitant cost of the hybrid seed coupled with enhanced input supply are the major hurdles to the farmers. At the same time, the productivity is still far below the world figures. The comparatively cheaper public sector hybrids could not reach the farmers, in masses, due to laborious seed production methods which are based upon hand emasculation and hand pollination.

Male sterility and self incompatibility have been the useful tools in economic hybrid seed production of vegetable crops (Joshi et al. 2000). Male sterility has been used successfully in developing sweet pepper hybrids in Israel (Shiffriss and Rybski 1973) and China (Fan et al. 1999) but no such efforts have been made in India. In the past, many researchers like Pushpa and Shambulingappa (1981) isolated a spontaneous male sterile plant from the population of cv. Jwala, but their utilization has been reported by Lakshmi et al. (1988), who had used the genic male sterility successfully in developing hybrids. In Capsicum, the control of nuclear male sterility has been reported to be monogenic recessive (Shiffriss and Rybski 1973, Meshram et al. 1982, Patel et al. 1998 and Theruvelavan et al. 2002). Similarly natural male sterile mutant with excessive vegetative growth and bushy habit was observed in CA 452-1 in which the male sterility was governed by a single recessive gene ‘ms’ (Meshram and Narkhede, 1982). Matsunaga et al. (2007) revealed that genic male sterility was controlled by a recessive gene.

So to overcome the tedious job of hand emasculation, efforts were made to identify male sterile gene(s) in hot-pepper for easing the job of hand emasculation. Thus, the mode of inheritance of male sterility in the identified spontaneous mutant plant was investigated in this study.

A male sterile plant was observed in the population of local line, DKC-5 at HRR, Dhaulakuan, Himachal Pradesh, India. It was bearing purple, shriveled, squeezed anthers but without pollens and drooping fruits. Morphologically, it resembled the natural mutant identified by Meshram et al. (1992) which was having

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Eco-friendly management of Alternaria blight of carrot (Daucus carota L.)

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Received: Mar 18, 2011; Revised: Mar 29, 2011; Accepted: Jul 10, 2011

ABSTRACT Carrot (Daucus carota L.), an important root crop of European countries and America, is becoming popular in India due to its high nutritive and medicinal value, and good taste. Alternaria leaf blight of carrot (Alternaria dauci) causes serious damage to the crop (up to 60%). To formulate an eco-friendly management strategy, attempts were made to standardize depth of sowing, selected appropriate inter crop and resistant cultivar. The incidence of Alternaria leaf blight of carrot due to A. radicina was maximum when carrot was sown in shallow and minimum depth of soil. Intercropping of carrot with radish was effective in reducing the disease intensity. Growing of single row carrot in double row of radish and planting as early as on 10th October effective by reduced the disease incidence. Ten available varieties of carrot were screened for disease resistance. None was found to be immune but only two (Samson and Nandril) appeared to be resistance which can be utilized for breeding programme for Alternaria leaf blight of carrot. Spraying with Indofil M-45 significantly reduced leaf blight (16.20 %) and subsequently increased root yield (250 q/h).

KEYWORDS Alternaria dauci, carrot, varieties, date of sowing, inter cropping, fungicides

Carrot (Daucus carota L.) is gaining importance in Indian vegetable market due to its nutritional value including flavour, taste, crotchef and anticancerous properties. It is a good source of healthy building substances, especially vitamins, proteins, carbohydrates, fats and minerals (Chauhany 1996). Among various factors responsible for its low productivity, diseases are the major one and among them Alternaria blight of carrot have been posing serious problem to the low productivity of carrot during the recent years in Uttar Pradesh. Keeping in view, the economic importance of carrot serious nature of disease, the present study was carried out on the effect of date of sowing, disease severity, screening of disease resistance varieties and chemical control of the disease.

A field trial was conducted at Vegetable Research Farm, Kalyanpur, Kanpur. The plot size was 9 m² with plant to plant and row to row distance of 8 and 30 cm respectively and normal cultivation methods were adopted otherwise stated. To evaluate for disease resistance, ten varieties were sown and the host resistance was measured by categorization based on the severity of disease (Table 1). To test the effect of date of sowing on disease severity and root yield of carrot, seeds of carrot cv. Pusa Kesar were sown on four different dates at ten days interval i.e. October 10, 20, 30, November 9 and 19 of 2005 and 2006. The effects of intercropping with radish were tested by growing the crops in the following sequence: T1-Carrot, T2-Carrot (single row) + Radish (single row), T3-Carrot (single row) + Radish (double row), T4-Carrot (double row) + Radish (single row) and T5-Carrot (double row) + Radish (double rows). To test the efficacy of fungicides, seven treatments including six fungicides viz Indofil M-45 (0.2%), Zineb (0.2%), Bifloxb (0.2%), Barvastin (0.2%), Mateo (0.2%), Anmitec Gold (0.1%) and unsprayed check were taken for chemical treatment. The first spray of fungicides was given at the onset of disease followed by two more sprayings at 15 days interval. The control plots were sprayed with water. Final observations were recorded at 15 days after the last spray. Observations on the intensity of disease
Standardization of fertilizer requirements of nursery plants of apple

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Received: Jan 10, 2011; Revised: Feb 16, 2011; Accepted: Jul 10, 2011

ABSTRACT The present studies were carried out to standardize nitrogen, phosphorus and potassium requirement of apple nursery plants from 2008 to 2010. Bench grafted plants of apple cv. Red Chief and Vance Delicious were planted in the field at a spacing of 22.5 × 22.5 cm in the month of February at Regional Horticultural Research Station, Bajaura, Kullu, Himachal Pradesh. Three levels of nitrogen (N₁=50, N₂=100, N₃=150 kg/ha), phosphorus (P₁=25, P₂=50, P₃=75 kg/ha) and potassium (K₁=50, K₂=100, K₃=150 kg/ha) were applied. The Experiment was laid out according to factorial RBD with three replications. Full dose of phosphorus, potassium and one-third dose of nitrogen were applied at the time of planting. Rest of the nitrogen was applied in two split doses at monthly interval. The maximum plant height, trunk diameter, plant weight, number of roots and length of roots were recorded with N₁, P₂ and K₃ levels during all the seasons. The interactions among different levels of N, P and K revealed that the highest plant height, trunk girth and plant weight were recorded with N₁, P₂, K₃ levels. However, the highest number of roots was recorded with N₂, P₁, K₃ levels and root length with N₁, P₂, K₃ levels. The lowest plant height, trunk diameter, number of roots per plant and root length was recorded with N₁, P₁, K₃ levels and plant weight with N₁, P₁, K₂. It can be concluded from the above studies that N₁, P₁, K₃ levels can be recommended for obtaining good growth of nursery plants of apple.

KEY WORDS Plant height, plant weight, trunk girth, apple

Apple is the major temperate fruit crop of Himachal Pradesh accounting for 64.5 % total area under fruits and 94 % of total fruit production. At present the total area under apple is 54725 ha and production is 51081 metric tonnes (Anon 2008). Apple is most remunerative crop as far as the income is concerned. Therefore large plantations are coming up in new areas and old orchards are being replaced as they have completed their life cycle. There is a huge demand of good quality apple plants every year. The temperate fruits are usually propagated on rootstock rather than on their own roots, because growing of fruit trees on rootstock have many advantages. The rootstock exerts, not only a, considerable influence on growth, precocity and cropping of the scion cultivar grafted on them but they also impart resistance to scion cultivars against adverse biotic and abiotic factors. Seedling rootstocks are most commonly and widely used rootstocks for apples in Himachal Pradesh. Bench grafted plants are raised on seedling rootstocks. The plants are salable in one year. The major problem for planting of an orchard is the availability of healthy and large size plants with good root system.

Trees require nitrogen, phosphorus and potassium in large quantities. The full bearing apple trees remove 72, 23 and 75 kg of N, P and K per hectare respectively from the soil every year. The yearly growth of plants and production of fruits depletes the soil of its nutrient reserve resulting reduction of native fertility. It is important to replenish the soil of depleted nutrients regularly. To produce healthy and large size plants the seedling require balanced dose of nitrogen, phosphorus and potassium. Therefore, the present studies were undertaken to find out the requirement of N, P, K and their effect on shoot and root growth of nursery plants of apple.

The present studies were carried out to standardize nitrogen, phosphorus and potassium requirement of apple nursery plants from 2008 to 2010 at Regional Horticultural Research Station, Bajaura, Kullu, Himachal
Performance of red raspberry (Rubus idaeus L) in trans-Himalayan region of India

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Received: Sept 19, 2011; Revised: Nov 02, 2011; Accepted: Dec 10, 2011

ABSTRACT Studies were carried out on red raspberry at RARS/KVK, SKUAST-K, Leh (Ladakh) for four years (2007 to 2010) on red raspberry introduced few years back in this region. To study the feasibility of this crop in higher altitudes the trial was laid out in polyhouse as well as in open conditions. The plant, foliage, floral and fruit characters were studied. The average weight in polyhouse and open conditions was 2.60 and 2.18 g, respectively. The crop performed well in Ladakh under both growing conditions with a minor superiority for some traits in polyhouse conditions. The fruiting and flowering was early in polyhouse conditions. But the new fruit crop can be grown under both conditions.

KEYWORDS Rubus, cane, plant, leaf, fruit, red raspberry, cold arid region

Ladakh region of Jammu and Kashmir having two districts viz. Leh and Kargil, represents the major cold arid region of the country. The region has different climatic conditions than rest of the country. The cold arid region has very short growing season and very chilling winters. Hence the choice of growing different fruit crops is very limited and only few fruit crops coupled with many problems are being grown in this region.

So, there is strong need to introduce new fruit crops in the region to diversify the horticultural scenario of the region. The family Rosaceae is the most important in fruit crops which has many fruit genera of commercial importance and genus Rubus is very important member of this family. In other countries many fruit crops of this genus has been commercialized under small fruits. In India the work has been carried out only few indigenous species while in other countries lot of improvement work has been carried out in rasp berry. Few year back an un descriptive type of red raspberry was found introduced from France by tourist. Due to less know how to the farmer regarding the crop, it was introduced at Regional Agricultural Station/ Krishi Vigyan Kendra, Leh before it get extinct from the farmer. This fruit was successfully grown under polyhouse as well as open conditions and seems to be promising for the region. So, the study was conducted to see the performance as well as to describe this undescrptive type of red raspberry which can be released as a new fruit crop for the region.

Investigations were carried out on undescrptive type of red raspberry at Regional Agricultural Station and Krishi Vigyan Kendra, Sher-e-Kashmir University of Agricultural Sciences and Technology (K), Leh (Ladakh) in polyhouse and open conditions. The experimental site is situated at ’33° 58.551’ NS, ’77° 41.995’ EW, 10888 feet amsl. This red raspberry was found introduced by tourist from France and planted in polyhouse of a farmer. But due to less know how regarding the crop to the farmer, few plants were introduced at RARS, Leh from the farmer before it get extinct. First these plants were multiplied and then trial was laid out to test the feasibility of this crop under protected and open conditions. Trial was laid out with three replications in polyhouse and open conditions. Five plants in each replication were used for recording data. All slandered procedures and methods were used for recording data on various parameters.
Effect of bio-regulators on performance of tomato under naturally ventilated polyhouse during off-season

SANCHITA BRAHMA • DB PHOOKAN

Received: Aug 10, 2011; Revised: Oct 12, 2011; Accepted: Dec 10, 2011

ABSTRACT Tomato is a universally accepted vegetable crop popular throughout the world for its high pro vitamin A and vitamin C contents, which provides an array of processed products like juice, soup, puree, paste, ketchup etc. To determine the effect of bio-regulators on growth, flowering, fruit set and yield of tomato (var. Arka Alok) inside naturally ventilated polyhouse during off-season, a field experiment was conducted during 2005-06 at the Department of Horticulture. The study revealed that application of 25 ppm GA₃ at the time of flowering and 15 days after first application produced highest fruit yield per plant per m² during July (5.79) and August (4.84) respectively.

KEYWORDS Tomato, bio-regulators, growth, yield, polyhouse

In Assam, it is one of the major commercial vegetable crops grown throughout the state during winter season for fresh consumption as well as processed products. During summer when the temperature exceeds 29°C, the fruit set is impaired because of various factors like style elongation, lack of pollination, reduction in pollen germination, slow pollen tube growth (Kalloo 1985), high flower drop and low yield of marketable fruits. Plant bio-regulators have tremendous beneficial effect on solanaceous vegetables in promoting flowering and fruit setting. Beneficial effect of plant growth regulators for improving the plant growth, fruit set, fruit development, yield and quality of various solanaceous vegetables (Bose and Som 1986) but efficacy varied with different climatic conditions. Oyewole and Aduayi (1992) reported that micronutrients can be used to improved fruit sets in tomato. However no information is available regarding effect of plant bio-regulators in tomato during off-season for polyhouse cultivation, hence an investigation was undertaken to find out the effect of plant bio-regulators on growth, yield attributing traits and yield of tomato variety Arka Alok during off-season under low cost polyhouse.

The experiment was conducted during the summer season (July and August) in the year 2005-06 under low cost polyhouse in the Experimental Farm of the Department of Horticulture, Assam Agricultural University, Jorhat. Four weeks old tomato seedlings of the cultivar Arka Alok were planted under low cost gable even shape polyhouse, constructed with locally available bamboo and covered with U.V. stabilized low density polyethylene film (LDPE) of 200 micron thickness as cladding material. Bioregulators viz. GA₃ 10 ppm, GA₃ 25 ppm, PCPA 50 ppm, NAA 10 ppm + Boron 1 %, and along with water spray as control were applied at the time of flower initiation and 15 days after first application. The trial was laid out in randomized block design with three replications. Regular irrigation, fertilization, stacking and crop protection measures were adopted as per package of practice during the course of investigation. Different observations on growth, yield attributing traits and yield were recorded by using standard procedures. The data were statistically analysed as per Panse and Sukhatme (1995).

In the present study plant height, number of branch, days to 50% flowering, 50 % fruiting, fruit set percentage, number of fruits per plant, fruit weight, yield

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SHORT COMMUNICATION

Impact of integrated nutrient management on the economic cultivation of turmeric (Curcuma longa L.) in an Acid Alfisol of Himachal Pradesh

DHANBIR SINGH

Received: Mar 05, 2011; Revised: Apr 07, 2011; Accepted: Jul 10, 2011

ABSTRACT The productivity of turmeric in Himachal Pradesh (0.70t ha\(^{-1}\)) is still below the India average (4.95 t ha\(^{-1}\)). The main reason for low productivity is that these crops are largely cultivated under nutrients starved conditions. Keeping this fact in mind, field experiment were conducted during kharif seasons on turmeric (Curcuma longa L.) variety T-12 at research farm of Department of Soil Science CSK HPKV, Palampur (HP) on silty clay loam soil with eleven treatments including a control. The pooled results of two years showed that highest mean yield (150.8q ha\(^{-1}\)), highest income over control (50,382 ha\(^{-1}\)) and highest net returns (63,566 ha\(^{-1}\)) were recorded in the treatment, 100 % NPKS + 20t FYM ha\(^{-1}\) as soil mulch. Whereas, highest benefit cost ratio (1.299) was recorded in treatment 100 % NPKS.

KEY WORDS Curcuma longa., INM, yield, net returns, benefit cost ratio

Turmeric, an important commercial spice crop has a significant medicinal value. The nutrient requirement of this crop is quite high due to shallow rooting and capacity to produce large amount of dry matter per unit area. Therefore, the need based application of manures and fertilizers alone or in combination in right doses is essential for optimum growth. In fact, the addition of organic manure leads to considerable increase in crop yield and improves physical, chemical and biological properties of the soil and maintain favourable environment for the growth of the crop (Dudhat et al. 1997). But, alone use of organic manures is not sufficient to meet the crop nutrient requirement. Likewise, intense use of chemical fertilizers alone pose serious threat to sustainability of agriculture production. Therefore, the use of both organic and chemical fertilizers in required quantity assumes special significance as complementary and supplementary to each other in crop production. Looking into the low productivity of turmeric in the state (0.70 tonnes ha\(^{-1}\)) and in the country (4.95 tonnes ha\(^{-1}\)), there is a need to improve the productivity of the crop. Hence, integrated nutrient management is of immense importance in turmeric which is one of the high value crops for small and marginal farmers of Himachal Pradesh and by improving the productivity of crop, the socio-economic status of the farmers of the state can be improved further. Keeping the above facts into consideration, the present investigation was carried out at Palampur Agriculture university farm during kharif seasons.

The experiment was conducted on Turmeric (Curcuma longa L.) variety T-12 at research farm of Department of Soil Science, Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvakendra, Bajaura Distt. Kullu Himachal Pradesh - 175 125, India

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SHORT COMMUNICATION

Land use pattern in north-east and eastern hill states of India - a comparative study

SK SRIVASTAVA

Received: Apr 15, 2011; Revised: May 16, 2011; Accepted: Aug 25, 2011

ABSTRACT  Land resources of a region are not only determined by its geographical area but also by its uses. Hill agriculture suffers from several maladies. In view of the aforesaid facts this study has been planned to compare the land use pattern, especially for agricultural and other related land use of the states belong to North-East and Eastern hill (NEEH) states of India. The NEEH region of the country is still lagged in agricultural development. The states of the region are characterized by a group of low performing states, poverty ridden, very low level of infrastructure, etc., therefore, this region is purposively selected for this study. The north-east hill region comprised of seven states viz. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura. Whereas, the state of Sikkim, the only hill state in the eastern part of country is also included in this study. And, therefore, another hill region is formed as North-East and Eastern hill (NEEH) region of India for this study. Only secondary data has been used in this study applying descriptive statistical analysis. The NEEH states contributed only 7.6 % of the total reported area of India. Except Arunachal Pradesh and Assam, all other states of this hill region contributed less than 1 % to the national reported area. Share of forests in the reported area of respective state was as high as 93.74 % in Arunachal Pradesh. This NEEH region, which shared about 8 % of national geographical area, contributed less than 3 % to the country’s net sown area. This clearly indicates uneven distribution of land use in the country. The study revealed that there is ample scope of area expansion for agricultural use in all the states of NEEH region with varying magnitude. On an average the cultivated area can be increased by about 40 % in this region of the country. Only about 12 % of net sown area in the NEEH region of the country was irrigated and rest about 88 % area was solely dependent on rains. The state of Manipur ranked first in respect of irrigated area, which registered the level of 46.43 %. The study in general reveals that there is much scope for increasing agricultural production in almost all the states of NEEH region by putting more area under agriculture, through various soil conservation and improvement techniques, and also by increasing agricultural productivity with increased cropping and irrigation intensities.

KEYWORDS Land use, reported area, north – east, hill states, cropping intensity.

Land being the most important natural resource deserves the top priority in the study of agricultural development of a country or a region. Land resources of a region are not only determined by its geographical area but also by its uses. The most important problem, which India faces now days, is the increasing pressure of population on land resources. Land is limited while population is increasing continuously. Data on land utilization provide the area figures showing distribution of the total geographical area into its various uses. For the study of agricultural development and integration of economic and technical approach in agricultural planning, land use statistics on agriculture and other related aspects are needed (Srivastava 1997). 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. High mountains and hills, snow peaks and tops, rivers and rivulets, glaciers, terraced fields, etc. are the integral features of hills of India.

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Bioefficacy of Lannate 40 SP (Methomyl) against leaf defoliators of soybean

NEETA GAUR ● PARUL CHAUDHARY ● JITENDRA KUMAR ● A K PANDEY

Received: Mar 05, 2011; Revised: Apr 11, 2011; Accepted: Apr 19, 2011

ABSTRACT An experiment was conducted to evaluate the bioefficacy of Lannate against leaf defoliators of soybean. Soybean variety PK 416 was sown in the plots (4.5x3 m²) with 45x5 cm spacing. Eight treatments i.e. Lannate 40 SP @ 200, 250, 300, 350, 400, 800 g ai/ha, Triazophos @ 0.8 l/ha along with untreated control were given as two sprays given at 68 and 82 days after sowing. Results indicate that spray of Lannate 40 SP @ 200, 250, 300, 350, 400, 800 g ai/ha and untreated control was done at 68 days and 82 days of sowing in crop. Lannate 40SP @ 400g ai/ha gave effective control of Tobacco caterpillar and green semilooper and significantly gave higher yield over untreated control. Triazophos @0.8 l/ha proved least effective. No phototoxic symptoms were observed on any of the treatments.

KEYWORDS Lannate 40 SC, leaf defoliators, soybean

Soybean [Glycine max (L.) Merril], member of family leguminacae occupies unique position among edible legumes. The soybean (Glycine max) is native of East Asia. The plant is classified as an oilseed rather than pulse because of a good source of protein. Together oil and protein content account for about 60% of dry soybeans by weight, protein at 40 % and oil at 20 %. The remainder consists of 35% carbohydrate and about 5% ash. At present, the total area of soybean crop in India is 9.7 million ha with the production of 9.6 million tonnes and on an average yield of soybean is 1006 kg per ha in Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, Andhra Pradesh and Chattisgarh state of India. Approximately, 273 insect pests have been reported, Stem fly (Melanagromyza sojae), Whitefly (Bemisia tabaci), Girdle bee (Obereaopsis brevis), Bihar hairy caterpillar (Spilarctia obliqua), Tobacco caterpillar (Spodoptera litura), Green semi looper (Thysanoplusia orichalcea) are considered to be the serious pests of this crop (Singh 2001). The indiscriminate pesticide use has upset the pest population leading to resurgence, secondary outbreaks, resistance and toxic residues. Therefore research has been done to develop new molecules with different modes of action. So there is a need to test the efficacy of these new molecules. This experiment was therefore conducted to evaluate the bioefficacy of Lannate against leaf defoliators of soybean.

The investigations were carried out during Kharif 2008-09 at Normon E. Borlog, Crop Research Centre, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India in Randomized Block Design with three replications. Soybean variety PK 416 was sown in the plots, each measuring 4.5x3 m² size with 45x5 cm spacing. There were eight treatments including untreated control viz Lannate 40 SP @ 200, 250, 300, 350, 400, 800 g ai/ha and Triazophos @ 0.8 l/ha along with untreated control. The first insecticidal spray was given at 68 days after sowing and second spray was given at 82 days after sowing. The spraying was done during evening hours with back pack spray pump with hollow cone nozzle. The population of tobacco caterpillar and green semiLooper was counted on one meter row length at three places in each plots at 3, 7 and 10 days after application and average population in MRL was worked out. The stem fly infestation was recorded at the time of harvest by dissecting 15 plants per plot. The yield of soybean was also recorded in each treatment. Average population of natural enemies’ spiders and Coccinella
SHORT COMMUNICATION

Effect of irrigation and fertilizer application methodologies on soil properties in pea

UDAY SHARMA

Received: Dec 20, 2010; Revised: Mar 22, 2011; Accepted: Apr 19, 2011

ABSTRACT The experiment to study the effect of different irrigation and fertilizer management systems on soil properties in pea was conducted taking three different management systems and six of fertilizer levels and sources. The data on the soil physico-chemical properties reveals that the drip irrigation and application of 150% recommended dose of fertilizers in combination with FYM application to the soil resulted in maximum soil macro and micro nutrient levels and was comparable with 100% dose as well as to drip fertigation at 150% doses. The use of drip irrigation systems and integrated use of organics was found to have a combined effect on the yield maximization of peas while maintaining soil fertility and achieving the goals of reducing nutrient losses for environmental safety.

KEY WORDS Soil properties, fertilizer management, irrigation, pea

Garden pea (Pisum sativum L.) is one of the most important leguminous vegetable crops grown in India. In Himachal Pradesh it occupies an area of 18.9 thousand hectares with a total production of about 202.9 thousand tones (NHB 2010). The farmers get remunerative prices of peas in hill regions because of its off-season availability in the plains. Irrigation and fertilizer management in conjunction play a critical role in determining the yield and quality traits of any crop. The Intensive cultivation coupled with use of unbalanced and inadequate fertilizers accompanied with restricted use of organic manures and biofertilizers have made the soils not only deficient in the nutrients, but also deteriorated the soil health. Under such a situation the integrated use of chemical fertilizers alongwith organic manures and biofertilizers has assumed a great significance for the maintenance of soil productivity. Wilson et al. (1999) reported that in peas if soil nutrient levels are above the threshold then there is no yield increase with increasing fertilizer application and only water availability accounts for the differential yields among different sites. Drip irrigation has proved its superiority over other conventional methods due to its precise and direct application of water in the root zone. Fertilization results effectively in increasing both water and nutrient efficiency when correctly applied. Besides improving yield and quality of the crops and minimizing management costs, fertigation also reduces mineral leaching and nutrient losses, thereby proving beneficial for the environment (Sambo et al. 2005).

Sood and Sharma (2002) while comparing different irrigation and nutrient applications in potato found that the differences in the soil pH, nitrate nitrogen content, available P and K contents of the soil due to these treatments were non-significant and the integrated nutrient management increased the organic carbon and N content of the soils. Singh et al. (2004) while investigating the effects of INM on properties of Molisols under okra-pea-tomato cropping sequence found an increase in soil N level under INM. They observed an improvement in soil properties with the buildup of organic carbon coupled with a marginal decline in bulk density.

Rajput and Kushwah (2005) investigated the effect of INM on peas cv Azad P-1 under Madhya Pradesh conditions and found that the highest yields were obtained with application of recommended doses of fertilizers but equivalent yields were also obtained with 50% recommended doses of fertilizers coupled with FYM and biofertilizer application. Singh and Haider

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MEMBERSHIP OF INDIAN SOCIETY OF HILL AGRICULTURE

Membership of the society shall be open to individuals from all nations and shall consists of the following categories of members with qualifying criteria as indicated against each. Membership can be obtained by filling a membership form and sending it to editorinchiefjha@gmail.com along-with membership fee as detailed ahead.

(i) Ordinary Members (annual Membership)
This membership shall be offered to the individuals interested in promotion of Hill Agriculture and its allied branches. This shall also be the minimum fee to be deposited per author for getting a paper published, in case it is accepted for publication. There shall be an annual fee of Rs. 500/- for individuals from all SAARC countries including India and US $ 30 for individuals from rest of the nations. Year shall be counted w.e.f. January 1 to December 31 of each year. If somebody deposits fee in October 2010 it shall be counted only for that year i.e. 2010.

(ii) Life Members (continuing Membership)
There shall be a one time life membership fee Rs. 3000/- for individuals from all SAARC countries including India and US $ 200 for individuals from rest of the nations.

(iii) Patrons (continuing Membership)
Any individual or institution making a payment of a substantial sum (as may be prescribed by the Executive Council from time to time).

(iv) Subscribers
Any corporate body / institution / library / association of persons can subscribe Journal of Hill Agriculture by making an annual payment of Rs. 1500/- for all SAARC countries including India and US $ 100 for rest of the nations.

Summary

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The membership fee can be deposited by any of the two methods as detailed below:

1. Through Bank Draft : May remitted through demand draft drawn in favour of INDIAN SOCIETY OF HILL AGRICULTURE payable at SBI Branch CHAMBA (Uttarakhand), Branch Code : 6534. The draft may be sent to the Editor-in-Chief Journal of Hill Agriculture through registered post only along-with duly filled membership form which can be downloaded from our website.

2. By Direct Deposit into ISHA’s Bank Account: Membership fee i.e. Rs 3000/- or Rs 500/- or Rs 1500/- as the case may be, plus Rs 30/- (as bank charges) amounting to Rs 3030/- or Rs 530/- or Rs 1530/- respectively, may also be directly deposited into the Bank Account of Indian Society of Hill Agriculture. The details are given as follows

Name of Bank : State Bank of India
Name of Branch: Chamba (Uttarakhand)
Branch Code: 6534
For NEFT/ RTGS Transfer IFSC Code: SBIN 000 6534
Name of Account Holder : Indian Society of Hill Agriculture
Account No. : 3119 0343 798

Important Note: If you directly deposit the fee into ISHA’s account please do not forget to send your duly filled (i) duly signed membership form, (ii) bank transaction Id (iii) scanned copy of stamped deposit slip (counter foil). The information may be sent by e-mail to editorinchiefjha@gmail.com

The above revised fee of ISHA membership shall be applicable w.e.f. 1st January, 2011

(Satish Kumar Sharma)
Editor-in-Chief, JHA
ditorinchiefjha@gmail.com
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