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INPUT MANAGEMENT IN ORGANIC FLORICULTURE- AN OVERVIEW

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ABSTRACT

Organic farming indicates a food production system where traditional wisdom and ancient knowledge of Indian Farming such as crop rotations, mixed cropping, mixed farming, organic manuring, residue recycling, agro-forestry systems are amalgamated with modern practices of crop cultivation and livestock management to enhance profitability without dependence on off-farm resources. In India, Uttaranchal, North-East States, Chhatishgarh have taken initiatives for promoting organic farming. The potential organic sources of plant nutrients are green manure crops, crop rotation, crop residues, organic manures, FYM, Night soil, sludges, oilcakes, blood meal, compost, phospho-compost, vermin-compost, biogass slurry, agricultural wastes, press mud, Biodynamic preparations, biofertilizers etc. Major organic produce dominate exports for developing countries include plantation commodities viz. tea, coffee, spices, high value fresh and processed fruits and vegetables, oilseeds, cotton, cereals, pulses and meat/poultry and fish products. In floriculture, organics are used as substrate media, as a component in plug plant production, in preparation of nursery for flower seeds, as a component for pot mixture for foliage plants, as important media for greenhouse crops to improve the soil physical properties, as a soil drench of bulb soaking or foliar spray, in propagation of ornamental crops, in the hardening of tissue cultured plants and as a plant protection.

KEYWORDS: Input Management in Organic Floriculture

INTRODUCTION

In ancient literature, such as Righveda, the use of animal dung as manure was reported. Atharvaveda indicated the importance of green manures which was practiced before 1000 B.C. Kautilya'sArthashastra recorded manures like oilcakes, excreta of animals etc. Ayurvedic medicinal plants should be grown even in organic manner. The concept of organic farming means 'A food production system where traditional wisdom and ancient knowledge of Indian Farming such as crop rotations, mixed cropping, mixed farming, organic manuring, residue recycling, agro-forestry systems are amalgamated with modern practices of crop cultivation and livestock management to enhance profitability without dependence on off-farm resources'. India is blessed with various types of naturally available organic form of nutrients but quality of these inputs needs to be improved through Integrated Nutrient Management (INM), Integrated Pest Management (IPM) and Integrated Weed Management (IWM) systems. Integrated Farming Systems make a linkage between organic farming and intensive agriculture (Singh, 2001).

Importance of Organic Farming

Improper farming practices such as monocropping, imbalanced fertilization, poor soil organic matter management, soil contamination, soil compaction, mining of soil nutrients, water logging, depletion of ground water, decline in soil biodiversity and changing pest and disease complex and application of imbalanced NPK fertilizers ratio of 7.9:3:1 as against normal values of 4:2:1 are the major factors for soil degradation. Looking the adverse effects of

fertilizers and chemicals stress is being given to promote organic farming. The data indicates that per consumption of fertilizers and pesticides in India is 91.5 kg and 0.38 kg, respectively which are far below than other countries. The unprecedented rise in population will lead to the increased demand of food. The projected population for 2020 is 154 crores for which there will be a requirement of 385 million tonnes of food grain (Bhattacharya, 2004). It is estimated that plant nutrients (NPK) addition during 2020 will be removal of 37.46 million tonnes nutrients by crops for which nutrient additions generally fall short of requirement i.e. 7.86 million tonnes. In this context, the projected (2025) availability of plant nutrients trapable from organic sources is 7.75million tonnes. Besides, there is growing demand for organic produce which gets higher remunerative price even if yields are lower. Most of people believe that organic farming is the right choice for the long term future of the earth.

In India, 74% farmers owning less than 2 ha of land can adopt organic practices easily and manage farm inputs and labour more efficiently. The average productivity of 1.0 t/ha of Traditional rainfed agriculture can be enhanced upto 2.0 t/ha through organic agriculture. There is tremendous potential to substitute organic fertilizers through organics mainly crop residues, green loppings, green manures, organic manures, oil cakes, bio-fertilizers, crop rotations, animal excreta etc. The existence of traditional knowledge and farming systems have strong linkage between agriculture, livestock and others which can provide better livelihood security to farm families. Varied agro-climatic conditions and longer growing periods are prevailing in India to meet the offseason growing demands of export and the domestic markets. The organic sector is growing at 25-30%, creating employment opportunities for production, processing and value chain at rural areas and also marketing in cities.

Present Status of Organic Agriculture

Organic agriculture is gaining importance in European countries, USA, Canada, Australia, Japan, China, India and others. In the world, 160 countries are practicing organic agriculture with a certified organic cultivated area of 37 million ha and non-agriculture organic area (wild harvest) of 41.9 million ha. India has the largest number certified organic producers over 67,725 with 3.95 million ha under organic farming. During 2010, India accounted for 1,624,339 MT of certified organic produce. This country is the largest producer of organic cotton. Karnataka the first state to introduce policy on organic farming on 24-03-2004 and organic movement in India. In India, Uttaranchal, North-East States, Chhatishgarh have taken initiatives for promoting organic farming.

North East States are selected because the land is almost virgin and the crops are virtually organic. The use of inorganic fertilizers and chemicals is meagre in the region. All the households are maintaining livestocks producing sufficient quantities of on-farm manures. The region is receiving very high rainfall leads to production of biomass including weeds, shrubs, and herb which could be efficiently used in organic production. The region has the potential of about 47 mt of organic manure including 37mt from animal excreta and 9 million tons from crop residues. The region is home to some niche crops like Assam lemon, Joha rice, medicinal plants and passion fruits. North Eastern Region (NER) accounts for 45% of total pineapple production in India. Sikkim is the largest producer of large cardamom in the world. NER is the fourth largest producer of oranges in India. Extent of chemical consumption in farming is less than the national average. Besides, eighteen lakh ha of land in NER can be classified as ‘Organic by Default’. In January, 2016, Sikkim has been declared as “First Organic State of India”.

Organic Market

Major organic produce dominate exports for developing countries include plantation commodities viz. tea, coffee, spices, high value fresh and processed fruits and vegetables, oilseeds, cotton,, cereals, pulses and meat/poultry and fish products. In 2000, Ministry of Commerce, Government of India, launched the National Programme for Organic Production (NPOP) to ensure focused and well directed development of agriculture. Recently, the following agencies have been approved as accreditation agencies by the Government of India to formulate the National Program for Organic Production.

- Agricultural and Processed Food Products Export Development Authority (APEDA)
- Spice Board
- Coffee Board
- Tea Board
- Coconut Development Board
- Directorate of Cashew and Cocoa Development

Under NPOP, documents such as national standards, accreditation criteria for accrediting inspection and certification agencies, accreditation procedure, inspection and certification procedures have been prepared on the basis of guidelines evolved by International Organizations viz., IFOAM, EU regulations and CODEX Standards.

Organic Sources and their Role

The potential organic sources of plant nutrients are green manure crops, crop rotation, crop residues, organic manures, FYM, Night soil, sludges, oilcakes, blood meal, compost, phospho-compost, vermin-compost, biogass slurry, agricultural wastes, press mud, Biodynamic preparations, biofertilizers etc. (Sharma, 2004). Organic sources improve soil structure, soil aeration, water holding capacity and reduce soil losses due to erosion. They supply nutrients in a balanced ratio and stimulate soil flora and fauna.

Organic sources for essential elements (De *et al* 2007)

Table 1

Essential elements	Sources
Phosphorus (P)	Poultry litter, rock phosphate
Potassium (K)	Cover crop, mined granite, basalt, feldsper
Calcium (Ca), Magnesium(Mg) and Sulphur (S)	Sea weed extracts, dolomite, gypsum, limestone, crab shells
Micronutrients (B,Cu,Fe, Mn,Mo and Zn)	Liquid sea weed extracts, rock powder

1 ton green leaf manure= 10 kg of ure

Optimum dose of green biomass = 4 to 5 tonnes/ha

Use of Organic Compost in Floriculture

- As substrate media
- As a component in plug plant production

- In preparation of nursery for flower seeds
- As a component for pot mixture for foliage plants
- As important media for greenhouse crops to improve the soil physical properties
- As a soil drench of bulb soaking or foliar spray
- In propagation of ornamental crops
- In the hardening of tissue cultured plants
- As a plant protection

Traditional Additives for Organic Agriculture

Traditional additives comprises of bulky organic manures mainly Farm Yard Manure (FYM) for improvement of soil total nitrogen (Bharadwaj and Guar, 1985); compost which can be prepared from crop residues, weeds and vegetative biomass, sugarcane trash and pressmud, coir waste, tea waste; green manures obtained from sunhemp, Sesbania aculeate, cowpea, cluster bean; sewage and sludge from cities and towns; sheep, goat and poultry manure; concentrated organic manures viz. oilcakes like castor cake, karanj cake, cotton seed cake, mahua cake, safflower cake, groundnut cake, linseed cake, rapeseed cake and sesame cake; meat meal, blood meal and fish meal which have adequate amounts of NPK (0.5-2.0% N, 0.2-1.0% P_2O_5 and 0.5-2.0% K_2O) and higher C: N ratio.

Adoption of Integrated Farming Systems

Integrated Farming Systems aim to increase production, income and to improve nutrition of small scale farmers with available resources. Components of Framing system includes all types of crops like field crops, horticultural trees, animals (cattle, buffalo, pig, goats, sheep, fish), sericulture, apiculture, mushroom cultivation, forage crops, flowers and vegetable cultivation, biogas production and non-conventional plant resources. An effective farming system include the cropping system (s), the livestock system (s) and the farm household. Diversified farming system increases productivity, profitability, balanced food ratio, adoption of new technology; solves energy, fodder, fuel and timber crisis; avoids degradation of forests and environmental pollution, generates employment and provides opportunities for Agro-industries by utilizing the natural resources efficiently and this will help in maintaining sustainability (Table 1).

Table 2: Main Components of Organic Crop Production

Diversification and integration of components	Sustainability	Natural Plant Nutrition	Natural Pest Management
Crop rotation	Crop rotation	Legumes in crop rotation	Diverse crop rotation
Animal manures	Efficient cropping system	Composting	Green manure
Composting	Cover cropping	Cowdung slurry	Cover crops
Intercropping	Intercropping	Green manure	Guard crops
Mulching	Biocontrol	Vermi-composting	Break cropping
Farm scapping	Mulching	Farm litter management	Use botanical extracts
	Resource conservation	Crop residues management	Weed and pest smothering crop
	Efficient recycling		Fire
			Sanitation
			Tillage
			Biological traps

IMPORTANT SUBSTRATE MEDIA FOR ORNAMENTAL PLANTS

Cocopeat

Cocopeat is a multi purpose growing medium made out of coconut husk. The fibrous coconut husk is pre washed, machine dried, sieved and made free from sand and other contaminations such as animal and plant residue. Cocopeat is a very good alternative to traditional peat moss and Rock wool. It has air filled porosity and high water holding capacity and is an ideal growing medium for the plant crops. It is 100% organic and eco- friendly, free from soil borne pathogen and weed. It has a pH of 5.7 – 6.5,EC level <1 mS/cm is ideal for plant growth.

Vermiculite

This is a micacious mineral produced by heating to 745^{o}C. These are expanded plate like particles having very high water holding capacity, aeration and drainage. Vermiculite is hydrated aluminium iron magnesium silicate material with accordion like structure. It has a very low bulk density, a neutral pH, a high CEC and small amounts of potassium and magnesium. It is well suited for propagation media.

Perlite

This is a siliceous mineral of volcanic origin. Perlite is rigid, sterile and essentially infertile with minimum CEC and neutral pH. Perlite may be included in the mix to increase aeration and to lower bulk density. It is generally recommended for use in a propagation media.

Rock Wool

It is produced by burning a mixture of coke, basalt, lime stone and slag from iron production at 1600^{0}c temperature. The fiber rock wool is available in cubes and slabs. It is non-biodegradable, pH is 7 to 8.5, no buffering capacity, contain calcium, magnesium, iron, manganese, copper and zinc, CEC is negligible, does not require pasteurization, light is weight, high water holding capacity and good aeration.

Peat

It is the common component of artificial growing media. Peat are composed of several species of plant including mosses, sedges and grasses. In a growing medium, the value of peat is determined by the type of plant material and degree of decomposition. Peat are classified into four categories viz, Hypnaceous moss, Reed and Sedge, Humus or Muck and Sphagnum Moss.

Humus or Muck

These peat are the decomposed debris of finely divided plant materials of unknown origin. It contains sufficient quantities of silt and clay particles and does not improve drainage or aeration. Humus is not recommended for use in growing media due to its rapid decomposition and particle size.

Sphagnum Moss

This is the dehydrated remains of acid bog plants from the genus Sphagnum. It is low in soluble salts, long lasting in the mixture, uniform in the composition and improves drainage and aeration. Sphagnum peat moss has a good water holding capacity, high CEC, low nutrient levels and a comparatively low pH (3.0-4.5). It is the most desirable form of organic matter for the preparation of growing media.

Bark

These are by-products of the pulp, paper and plywood industries. Hardwood bark is the common ingredient of a growing medium. Bark is aged with lime and leaching to reduce the risk of toxicity of plants. Hardwood bark along with nitrogen makes a good potting media. Soft wood bark is acceptable but it lowers the pH of a media and so, liming is required. Barks are lighter in weight, sterile and have capacity to retain water as well as to drain the same.

Vermi-Compost

It is prepared from the organic wastes upon the action of earthworms. It contains2.5-3.0% Nitrogen, 1.0-1.5% Phosphorus and 1.5-2.0% Potash.

Vermiwash

It is washings from the earthworms collected during the preparation of vermin-compost, used as spray in raising of nursery, lawn and orchids (Ismail and Pramoth, 1995). Vermiwash is rich in growth promoting substances.

FYM/ Compost

It is prepared from the decomposition of organic wastes through anaerobic organisms. It contains fair amount of macro and micro-nutrients and most commonly used organic supplement given to the flower crop cultivation. FYM contains 0.5-1.5% N, 0.4-0.8% P_2O_5 and 0.5-0.9% K_2O whereas Garden compost contains 0.5% N, 0.3% P_2O_5 and 0.8% K_2O.

Panchgavya

It is a natural growth promoter and contains essential plant nutrients. It is prepared by mixing of fresh cowdung (5kg), cow's urine (3 litres), cow's milk (2 litres), cow's curd (1 litre), cow's ghee (100g), sugarcane juice (3 litres), Tender coconut water (3litres), banana fruits (12 Nos.). Usually, 1 to 5% solution of Panchgavya at 15 days intervals is used only after filtering.

Coconut Water/Liquid Manures

Tender coconut water contains growth promoting substances such as cytokinin which is reported to increase vaselife of cut flowers and is also used in the tissue culture media. Liquid leaf (ground fern + *Artemisia vulgaris*) and cowdung manures are rich in various anions (Table 2) and cations (Table 3) and used as foliar spray for cultivation of commercial flowers.

Table 3: Anions in Liquid Leaf and Cowdung Manures Estimated by Ion Chromatography

Anion Concentration (ppm)	Liquid Manure: Water (1:30)	Liquid Manure: Water (1:20)	Liquid Manure: Water (1: 10)	Liquid Manure: Water (1:5)	Tape Water	Coconut Water (1:10)
Flouride	14.550	9.20	4.18	2.220	0.393	18.428
Chloride	91.71	58.40	29.61	17.835	3.230	2336.982
Bromide	15.848	10.78	5.43	3.136	0.285	4.884
Table 3: Contd.,						
Nitrate	101.70	66.43	33.48	15.308	0.312	--
Phosphate	174.924	122.79	64.74	53.746	0.238	351.182
Sulfate	939.069	615.21	308.03	138.693	14.825	86.558

Table 4: Cations in Tape Water and Coconut Water Estimated By Ion Chromatography

Cation concentration (ppm)	Coconut water (1:10)	Tape water
Sodium (Na)	166.573	--
Potassium (K)	1816.479	30.321
Calcium (Ca)	254.847	--
Magnesium (Mg)	135.442	5.115

Biofertilizers

These are ready to use live formulates of beneficial microorganisms which on application to seed, root or soil fix atmospheric nitrogen or solubilize/ mobilize plant nutrients or otherwise stimulate plant growth substances. These free living or symbiotic microorganisms directly or indirectly contribute nutrition to crop plants. Free living organisms fix nitrogen without any association with any other organisms e.g. *Azotobacte*r. Symbiotic association such as Legume-Rhizobium symbiosis and Anabaena-Azolla symbiosis expresses the mutual beneficial partnerships between the two organisms. Associative symbiotics fix nitrogen in C4 plants and the organisms responsible for this process is *Azospirillum*. Based on type of microorganisms, the biofertilizer can also be classified as Bacterial biofertilizers (*Rhizobium*, *Azospirillum*, *Azotobacter*, *Phosphobacteria*), Fungal biofertilizers (Mycorrhiza_, Algal biofertilizers (Blue Green Algae, Azolla), and Actinomycetesbiofertilizers (Frankia). Legumes on an average contribute 50-200 kg N /ha whereas biofertlizers containing microorganisms like *Rhizobium*, *Azotobacter*, *Azospirillum*, Blue Green Algae, Azolla may contribute 40-60 kg N/ha and P-solubilizers may add 20-30 kg P_2O_5 /ha.

Azospirillum excretes growth promoting hormone (IAA) which results in more root biomass. It promotes uptake of nutrients like NO_3, NH_4, H_2PO_4, K and Fe. In flowers and ornamental plants, seedlings are treated with 1.5-2.0 kg Azospirillum inoculants per hectare for getting beneficial effect. Azotobacter is well known to synthesize IAA, Gibberellins and B-vitamins and it has fungistatic properties. In flowers, seedlings treated with 1.5-2.0 kg Azotobacter inoculants per ha whereas bulbs/tubers are treated with 3.0-4.0 kg/ha for getting better effect.

Organic Substrate Media for Growing various Flower Crops

Compost, garden soil, carbonized rice hull, coir dust, saw dust, fine sand, poultry manure and other organic materials are used as potting materials for various ornamentals. Potting media should be sterilized in boiling water, solar irradiation or by burning or heating before planting to control soil borne diseases.

Table 5: Organic Substrate Media for Growing Various Ornamentals (De, 2013; Rajiv Kumar and L.C. De, 2007)

Name of ornamentals	Substrate media
Rooted cuttings	Sand, loam, leaf mould
Hard wood plants	Sand, loam, peat moss, leaf mould, humus, cowmanure
Rose	Cowdung, loam, sand
Bulbous ornamentals	Cowdung, loam, sand, leafmould, charcoal
Terrestrial orchids	Leaf mould, sand, caly soil, bone meal, saw dust, wood charcoal dust, wood shavings, manures
Epiphytic orchids	Charcoal, brickpieces, sphagnum moss, tree bark
Anthurium	Coirpith, coarse sand, brick pieces/tiles, sugarcane baggase, leaf mould, rockwool, sawdust, tree barks, wood shavings, poultry manures
Gerbera	Sand, coir pith/cocopeat, leaf mould, FYm, vermicompost
Foliage & potted plants	FYM, sand, leaf mould, cocopeat, Charcoal
Carnation	Peat moss, perlite, sand

Lilium	Agropeat, vermicompost
Chrysanthemum	Cocopeat, garden compost
Cymbidium orchids	Cocochips, cocopeat, brick pieces, vermiculite, osmocot, dry leaf fern
Dendrobium orchids	Cocochips, brick pieces, tree barks
Vanda orchids	Cocochips, brick pieces, tree barks, dry leaf fern
Phalaenopsis orchids	Cocochips, brick pieces, leaf mould, green moss, sphagnum moss
Oncidium orchids	Cocochips, brick pieces, leaf mould
Cattleya orchids	Cocochips, brick pieces, leaf mould, dry leaf fern

Biopesticides and Biocontrol Agents for Insect-pests and Disease management

There are several ways to control insect-pests in eco-friendly way with bio-control methods. Some of important tactics are

Cultural Practices

crop rotation, use of resistant varieties, mixed cropping, habitat manipulation, trap crops.

Physical and Mechanical Methods

Removal of infected/infested plants/plant parts, removal of visible eggs, larvae etc., use of light traps, use of pheromone traps, use of colour stripes etc.

Biological Control

Biological control is one of the important ways to manage insect pests and diseases in organic farming by using naturally occurring biological agents.

Predators

Biological agents which eat insect pests, e.g., frogs, lizards, ducks, spider, dragon fly, coccinellid beetle, meadow grass hoppers, mired bugs, crickets, ants, sparrows and other birds.

Parasitoids

These are friendly species which complete their life cycle on different stages of insect-pests. There are different types of parasitoids including egg parasitoids, larval parasitoids, pupalparasitoids, adults, egg-larval parasitoids, larval-pupalparasitoids etc., e.g., *Trichogramma*spp., *Bracon* spp., *Apantele*sspp, *Brachymeria* spp. An encyrtid wasp, *Anagyrus*sp (Howard) as a parasitoid of long tailed mealy bug, *Psuedococcuslongispinus*and Mealy bug, *Pseudococcus*sp. infesting Orchids from Sikkim, India.

Microbes

These microorganisms cause various diseases in the insect-pests. Fungi like *Beauvaria* spp., *Trichoderma* spp., *Metarrhizum* spp., *Entomophora* spp. act as biocontrol agents. Among viruses, Nuclear Polyhedrosisvirus, Granulosisvirus arebiocontrol agents. Bacteria like *Pseudomonas* spp., *Bacillus thuringiensis*, *Bacilluspopoli* act as biocontrol agents. Microbial biopesticides, *Metarhiziumanisopliae*and *Verticilliumlecanii*@ 2 ml/Litre of water was found effective in reducing the crawlers populations of Biosduval scale insect, *Diaspisbiosduvalii*with mean population reduction of 73.70 % and 81.35 %, respectively.

Naturally Plant Products

These are botanical pesticides derived from plants, e.g., pyrethrins, nicotenes, azadirachtin, rotenoneetc. Highest mean population reduction in mite population was observed in plants treated with 5 % extracts of *Allium sativum* and neem oil (0.03%), respectively.

Research Accomplishments

- A Network project on Organic Farming was initiated at UAS, Dharwad during 2004-05 under the aegis of ICAR's Project Directorate for Farming System Research, Modipuram.
- Dharwad Centre has made a significant contribution by standardizing the organic farming practices in important crops mainly soyabean, groundnut, chickpea, rabi sorghum, duram wheat, maize, chilli, potato and cotton.
- Significant impact of organic management practices on build up of soil organic carbon, improvement in available nitrogen, phosphorus, potassium, DTPA extractable Cu, Fe, Mn and Zn, soil physical properties, mainly bulk density, aggregate stability, MWHC and infiltration rate and soil biological properties noticed.
- The Technology has been developed for mass production of vermi-composts and earth-worms.
- The efficient strains of bio-fertilizers mainly Rhizobia, P-solubilizing micro-organisms, Ligno-cellulolytic cultutres, *Azospirillum*, *Azotobacter*and Fluorescent*Pseudomonas* have been identified and mass produced and supplied to the farmers.
- The UAS, Dharwad is pioneer in developing mass production technology for entomopathogenic fungi namely, *Nomuraeareleyi, Metarhiziumanisopilae, Beauveriabassiana, Lecanicilliumlecanii* and predator of wooly aphid, *Micromusigorotus.*

Limitation in Organic Farming

- The nutrient management, pest and disease management practices to sustain the yield levels during conversion period and standardization of package of practices for organic production.
- Small holdings and diversified farming situations need greater on-farm and farmers participatory technology development to get sustained gain in production.
- As profitability, environment and social relations need to be continually monitored to improve the system, creating a more sustainable agriculture require a closer relationship between agricultural research and producers.

Future Strategies

- Build institutional capacities through the support to research and education. Support institutions for incorporating organic agriculture in their formal research and education programmes.
- Promote rural resource based organic agriculture, keeping soil health, sustainability and productivity of agriculture as prime focus.
- Support organic farmers for their infrastructure development and other needs for conversion to organic agriculture.
- Allocate resources on priority areas of research leading to development of package of practices and validation of

innovations and ITK's.

- Facilitate formulation of organic farming policies by each state to implement the programme.
- Development of model organic farms and live museums at institutions and farmers fields for transfer of technology.
- Development of human resources for effective transfer of technology.
- Create mass awareness through seminar, trainings, conference, meetings also through print and electronic media.
- Address to the key issues such as crop productivity, natural resources, bio-safety, environmental quality, pest and disease management, food quality, animal and human health and certification.

REFERENCES

1. Bhardwaj, K.K. and Guar, A.C. 1985. Recycling of organic wastes, ICAR, New Delhi, pp.104.
2. Bhattacharya, P. 2004. Organic food Production in India. Agrobios India, Behind Nasrani Cinema, Chopasani Road, Jodhpur.
3. De, L. C**.** 2013.'Nursery and Landscaping'**,** Pp. 248Published by Pointer Publisher, Jaipur, Rajasthan (ISBN: 978-81-7132-731-7).
4. De, L. C**.,** Sanwal, S.K., Akath Singh, Babu, K.D.,Rajiv Kumar and Yadav, R.K. 2007.Organic Input Management in Important Horticultural crops of NEH Region. In:'Advances in Organic Farming Technology in India'(eds.) G.C. Munda, P.K. Ghosh, Anup Das, S.V. Ngachan and K.M. Bujarbaruah); Published by the Director, ICAR Research Complex for NEH Region, Umiam-793103, Meghalaya, Pp.585.
5. Kumar, Rajiv and De, L.C.2007. Organic Floriculture-Potential and Prospect. In: 'Advances in Organic Farming Technology in India'(eds.) G.C. Munda, P.K. Ghosh, Anup Das, S.V. Ngachan and K.M. Bujarbaruah); Published by the Director, ICAR Research Complex for NEH Region, Umiam-793103, Meghalaya, Pp.585.
6. Ismail, A.A. and Pramoth, A. 1995.Vermiwash, a potent bio-organic liquid 'ferticide'. In: Ismail Vermicology. The biology of earthworms. Orient Longman, pp. 92.
7. Sharma, A.K. 2004.A Handbook of Organic Farming.Agrobios India, Behind Nasrani Cinema, Chopasani Road, Jodhpur.
8. Singh, H.P. 2001. Organic farming approach for sustainable coconut cultivation. *Indian Coconut Journal*, 3-7.