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Trends and Impact of Organic Inputs in Floriculture

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Introduction:

Agriculture is a major contribution of economic development in India and floriculture being one of the parts of agriculture allied sector, the Government of India has identified floriculture as a sunrise industry and accorded 100% export oriented status owing to steady increase in demand of flower both in domestic and international. It has become one of the important commercial trades in agriculture. Indian floriculture industry has been shifting from traditional flowers to cut flowers for export purposes. The country has exported 16,949.37 MT of floriculture products to the world for the worth of Rs. 541.61 crores or 75.89 US$ millions in 2019-2020. United States of America, Netherland, Germany, United Kingdom and United Arab Emirates were major importing countries of Indian floriculture during the same period. Agricultural and Processed Food Products Export Development Authority (APEDA), is responsible for export promotion and development of floriculture in India. (APEDA, 2020)

Flowers are wonderful. They're natural, they're beautiful, they smell good, comes in endless variations, colour, combinations and arrangements that leave us in awe of what nature can produce. While all these things are true, there are also ethical issues and considerations to make when it comes to sourcing flowers. Just like food or fibers, flowers are an agricultural product which we often tend to forget easily or ignore as we don't consume flowers in the same way we consume food. Floriculture, however, uses more pesticides than almost any other industry. Pesticides are the standard in the industry and since flowers are not grown to be consumed, rules governing pesticides are more relaxed than they are food products. In Colombia 12 different pesticides are used, Ethiopia use 120 pesticides that are on the WHO negative pesticide list, including toxic chemicals (which Kenya still use) such as DDT and Methyl bromide. Workers are rarely trained on how to use these pesticides properly, resulting in multiple health problems and damage to local eco-systems. In particular pesticides pose a

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threat to water systems, as run-off from chemicals in growing fields often ends up in neighboring waterways. For example fish stocks in Kenya's Lake Naivasha, which are crucial to local communities, have collapsed as fertilizers drain directly into lake and have essentially turned toxic. This all shows that, we need to be questioning how our products are grown, and who is affected by the growing. (Anonymous, 2019)

Organic production is not simply the avoidance of conventional chemical inputs, nor is it the substitution of natural inputs for synthetic ones. Organic farmers can apply techniques first used thousands of years ago, such as crop rotation and the use of composted animal manures and green manure crops, in ways that are economically sustainable in today's world. In organic production, overall system health is emphasized, and the interaction of management practices is the primary concern. Organic producers implement a wide range of strategies to develop and maintain biological diversity and replenish soil fertility. (Organic Agriculture overview, USDA)

Organic standards prohibit the use of synthetic pesticides and discourage a pest and disease management strategy that substitutes reliance on synthetic pesticides with allowable organic insecticides. Under the standards a more holistic approach needs to be adopted, which essentially comes down to an integrated pest and disease management strategy without the chemicals. (Neeson, 2008)

Trends and Impact of Organic Inputs in Floriculture:

"Any kind of organic farming protects the health of people and the health of the environment," says Damery. Organic doesn't just have to be about food. Consumers have been favoring organic food for decades now. And for the same reason, they are favoring organic flowers. Since organic flowers don't have pesticides, fungicides, herbicides, insecticides, and/or growth regulators, they don't have a severe effect on your health. They are also better for the environment because without toxic chemical usage, these flowers are safer for farmers, and they promote the long-term sustainability of farmland.

Need for organic products and organic flowers:

The intention of organic farming is to keep the environment pollution free by cutting out those pesticides and chemicals. Chemical fertilizers have played a significant role in Indian agriculture, facilitating green revolution and making the country self-reliant in food production. However, it disturbs the soil health, leading to acidification, micro-nutrient

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depletion, soil degradation, lower crop yield and quality. Besides, use of chemical fertilizers may contribute to environmental risks like increase in global warming, ground and surface water pollution etc. in view of this, it is desirable that we may return to practices which is eco-friendly and meets the nutrient depletion and sustains quality production.

Organic inputs and their role: (Chait Jennifer, 2019; Singh, A.K. 2008)

Organic inputs are derived from the processing of plant and animal products that the farmer brings to his crop in order for it to express its production potential (they can be included as biological inputs). The commonly accepted organic inputs are manure, green compost, biogass slurry, FYM, night soil, agricultural wastes, crop residues, biofertilizers etc. The main role of organic inputs is to be used either as fertilizer for crops or as soil amendment. Organic inputs also enable a stable level of organic matter in the soil, which provides many benefits such as:

- Improvement of the soil structure
- Stimulation of the biological activity
- Improves water holding capacity
- Reduce soil loss due to erosion
- Supplement of nutrients to plants in a balanced ratio

The role of organic manures and biofertilizers to make the soil healthy as well as make unavailable form of soil nutrients to available form by enhancing mineralization and solubilization process. In soil by adding organic manures and microbial agents make easy uptake of nutrients when crop required comparing to chemical fertilizers (Vanilarasu and Balakrishnamurthy. 2014)

The use of manures as an organic source occupy and important place as they provide a scope for reduction in use of chemical fertilizers which can pollute soil in long term use (Sharma, 2005)

The application of organic manures increases the water holding capacity of soil and increase in moisture content in soil might enhanced the degree of metabolic activities at the growing apex enabling higher production of leaves and flowering in statice (Gayathri *et al.*,2004)

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

Essential elements	Sources

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Phosphorus	Poultry litter, Rock phosphate
Potassium	Cover crop
Calcium, Sulphur and Magnesium	Sea weed extracts, Crab shells
Micronutrients(B, Cu, Mn, Mo, Zn)	Liquid sea weed extracts

Use of organic manures as a source of nutrients was well documented by Mishra and Kapoor, (1992)

Addition of organic sources supplement a wide range of nutrients to the plants that help in maintenance of healthy status and increase yield in various flower attributes (Chaitra and Patel, 2007)

(Gulser *et al.*, 2011**)** determined that macro and micronutrients contents of *Tagetes erecta* increased with supply of chicken manure and barnyard manure.

Application of organic manures influenced flower longevity due to increased nutrient uptake by plant and greater development of water conducting tissue (Haripriya *et al.*, 2007) in rose.

An investigation was conducted, to study the effect of organic inputs on vegetative and floral attributes of chrysanthemum cv. Snowball. The treatments comprising of T_1: Recommended dose of NPK@30:30:30 g m^{-2}+ FYM (4 Kg m^{-2}); T_2:Rock phosphate + Microbial Consortium; T_3: T_2 + Vermicompost (2.5t ha^{-1}), T_4: T_2 + Vermicompost (5t ha^{-1}), T_5: T_2 + Compost (2.5t ha^{-1}); T_6: T_2+ Compost (5t ha^{-1}); T_7: Enriched compost (2.5t ha^{-1}); T_8: Enriched compost (5t ha^{-1}). Among the treatments applied maximum height (112.33 cm), number of leaves (59.67), leaf area (88.00 cm^2), stem thickness (1.33 cm) were recorded in Rock Phosphate + Microbial Consortium + Vermicompost (5t ha^{-1}) at all stages of plant growth. With respect to flowering, application of rock phosphate + microbial consortium + vermicompost (5t ha^{-1}) was found best as it resulted in bud visibility in minimum days (48.33 days), days to half bloom (82.00 days), days to full bloom (87.67 days), maximum flower stalk length (33.67 cm), size of flower (17.33 cm), and weight of flower (64.78 g). Maximum duration of flowering (25.74 days), shelf life (18.67 days) and vase life (17.33 days). Thus, it can be concluded from the findings that application of Rock Phosphate + Microbial Consortium + Vermicompost (5t ha^{-1}) can be recommended for commercial cultivation of chrysanthemum cv. Snowball. (Bordoloi *et al.*, 2019)

Use of organic compost in floriculture:

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- As a substrate media
- In preparation of nursery for flower beds
- As a component for pot mixture for foliage plants
- As important media for greenhouse crops to improve the soil physical properties
- In propagation of ornamental crops

Substrate media for ornamental plants:

1. Cocopeat – Cocopeat is a multipurpose growing medium made out of coconut husk. It is 100% organic and eco friendly, free. It has a pH of 5.7-6.5 and is ideal for plant growth.

   Cocopeat as growth media on lilium results indicated that flowering time of cultivated flowers was significantly sooner (M. Torkashvand, 2012)

2. Vermiculite – This is a micacious mineral produced by heating to 745^0C. It is well suited for propagation media.

   Media containing vermiculite either with soil or perlite observed to be best substrate for the growth, flowering and bulb production in lilium (Chaudhary *et al.*, 2018)

3. Perlite – This is a siliceous mineral of volcanic origin. It is generally recommended for use in a propagation media.
4. Rock wool – It is produced by burning a mixture of coke, basalt, limestone and slag from iron production at 1600^0C.
5. Peat – It is the common component of artificial growing media. Peats 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.
6. Sphagnum moss – This is dehydrated remains of acid bog plants from the genus sphagnum. It is the most desirable form of organic matter for preparation of growing media.
7. Vermicompost – it is prepared from the organic wastes upon the action of earthworms. It contains 2.5-3.0 % nitrogen, 1.0-1.5% Phosphorus, 1.5-2.0% Potassium.

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Vermicompost attributed to better supply of macro and micronutrients, enzymes and growth hormones governing to increase in flower size of china aster (Prabhat *et al.,* 2003). Similar results were also seen in gladiolus (Godse *et al.,* 2006)

Application of vermicompost increased post harvest attributes of cut sprays chrysanthemum due to presence of ethylene inhibitors or delays senescence of flower due to presence of cytokinin (Bohra *et al* ., 2014)

8. Vermiwash - It is washings from the earthworms collected during the preparation of vermicompost. It is used as spray in raising of nursery, lawn and orchids. It is rich in growth promoting substances.

Vermiwash is a major contributor of micro-nutrients to soil. It also enriched in certain metabolites and vitamins that belong to pro-vitamin D which enhance plant growth (Lalitha *et al.,* 2000; Ansari, 2008)

The assessment of Vermiwash indicated the presenceof micronutrients in significant quantity (Kale, 1998; Ismail, 2005)

9. 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 flower crop cultivation. FYM contains 0.5-1.5% N, 0.4-0.8% P_2O_5, 0.5-0.9% K_2O, where garden compost contains 0.5% N, 0.3% P_2O_5, and 0.8% K_2O.

Addition of cow manures at 40% level resulted in high growth values of marigold plant (Rahbari, 2013)

25% compost as treatment given in begonia resulted in highest dry weight and number of flowers (Grigatti *et al.,* 2007)

Composted separated cattle manure were high substitute potting media for ornamental plants (Chen *et al.,* 1988)

10. Panchgavya – it is a natural growth promoter and contains essential plant nutrients. It is prepared by mixing of fresh cow dung (5 kg), cow's urine (3 L), cow's milk (2 L), cow's curd (1 L), cow's ghee (100 g), sugarcane juice (3 L), tender coconut water (3 L), banana fruits (12 nos). Usually, 1-15% solution of Panchgavya at 15 days interval is applied only after filtering.

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In jasmine, foliar application of 30 % level of Panchgavya one before flower initiation and other during bud setting phase ensured continuous flowering with exceptional aroma and fragrance (agritech.tnau.ac.in)

Panchgavya spray was also reported as effective on all the crops than the recommended nutrients and growth regulators in terms of higher growth and productivity (Somasundaram, 2007)

11. Coconut water/ Liquid manures – Tender coconut water contains growth promoting substances such as cytokinin which is reported to increase vase life of cut flowers and is also used in tissue culture media. Liquid leaf (ground fern + *Artemisia vulgaris*) and cow dung manures are rich in various anions and cations and used as a foliar spray for cultivation of commercial flowers.
12. Biofertilizers – These are ready to use live formulates of beneficial microorganisms which on application to seed, root, or soil fix atmospheric nitrogen or solubilize plant nutrients or otherwise stimulate plant growth.

Biofertilizers are cost effective and renewable source of plant nutrients to supplement chemical fertilizers (Boraste *et al.*, 2009)

Use of biofertilizers reduces reduces per unit consumption of inorganic fertilizers and increase the quality and quantity of flowers (Syamal *et al.*, 2006)

Azospirillum has a role in N fixation and is also involved in the production of gibberellins and cytokinin which enhance the growth of plants and flower fresh weight in carnation (Rajesh *et al.*, 2006)

The role of biofertilizers to make the soil healthy as well as make unavailable form of soil nutrients to available form by enhancing mineralization and solubilization process. In soil by adding organic manures and microbial agents make easy uptake of nutrients when crop required comparing to chemical fertilizers (Vanilarasu and Balakrishnamurthy., 2014)

Pre-plant organic fertilizers:

Fertilizer material	Estimated NPK	Nutrient release
Alfalfa meal	2.5-0.5-2.0	Medium-fast
Blood meal	12.5-1.5-0.6	Slow
Crab meal	10.0-0.3-0.1	Slow
Rock phosphate	0.0-18.0-0.0	Slow-very slow

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Soyabean meal	6.6-1.5-2.4	Slow-medium

Organic fertilizers are effective in promoting environmental sustainability and plant growth after long term use. Compared with conventional organic fertilizers, the abundant organic matter and soluble nutrients in the liquid organic fertilizers could maintain soil sustainability and plant health (Canfora *et al.*, 2000)

Organic fertilizers and their extracts enhance soil fertility via improved nutrients retention and cycling and also play an essential role in growth and yield of plants (Khalid & Shafri, 2005)

Adding different organic fertilizers to the soil or to plant as a foliar application resulted in healthy growth and increased flowering in *Borago officinalis* plant (Ezz Ei-Din & Hendaury, 2010)

An experiment was conducted to study the effects of liquid organic fertilizers on plant growth and Rhizosphere soil characteristics of chrysanthemum. To promote the productivity of chrysanthemum, five sources of liquid organic fertilizers (L_1 –L_5), as well as chemical fertilizer, were applied at an early age of the growth cycle to investigate their effects on plant growth. In the short term pot experiment, the liquid organic fertilizers significantly promoted root and above ground growth by 10.2-77.7% and 10.7-33.3%, respectively compared with chemical fertilizers. The order of growth promotion was: L_1 (shrimp extracts) > L_2 (plant decomposition) > L_4 (Sea weed extracts) > L_5 (fish extracts) > L_3 (vermicompost). Morphological and chemical analysis indicated that, compared with other organic fertilizers, the treatment with shrimp extract (L_1) produced the greatest increase in root dry weight, total length, surface area, volume, tips and thick root length, respectively. Furthermore, the shrimp extract treatment significantly increased the nutrient contents and altered the soils functional microbial community at the rhizospheric level compared with the chemical fertilizer treatment. Thus, shrimp extract liquid organic fertilizers could be part of an effective alternative to chemical fertilization during the early stage of chrysanthemum growth.(Rongting *et al.*, 2017)

Natural Insect-pests and Disease control: (Linker *et al.*,)

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

1. Cultural practice – crop rotation, use of resistant varieties, mixed cropping, trap crops

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2. Physical and mechanical methods – removal of infected/infested plant/plant parts, removal of visible eggs, larvae, use of light traps, use of pheromone traps, use of colour stripes.
3. Biological control using insect pathogens – organisms that cause disease in insects can be exploited to help control pest populations by managing the environment to favor insect disease. The use of insect pathogens to manage pests is called microbial control. Fungi like *Beauvaria*spp, *Trichoderma* spp. act as Biocontrol agents. Among viruses, nuclear polyhedrosisvirus, Granulosisvirus, and bacteria, *Pseudomonas* spp, *Bacillus thuringiensis*. Microbial biopesticides *Metarhiziumanisopliae* and *Verticilliumlecan.*
4. Biological control using insect as natural enemies – Farmers can manage their fields to provide habitats for species that eat and live on pest insects. This can be achieved through conserving and augmenting beneficial populations.
5. Naturally plant products – These are botanical pesticides derived from plants e.g. pyrethrins, nicotens, azadirachtin when used with above pest management strategies, can help stress insect pest population.

Change is possible – inorganic to organic flowers:

1. Grow your own
2. Buy local and organic
3. Ask local florist to go organic
4. Buy organic.

Benefits of organic over conventional farming:

- Sustainability over long term
- Improves soil physical structure
- Decrease water contamination
- Air and climate change
- Biodiversity
- Ecological services

Constraints:

- Organic manure contains fewer amounts of nutrients.
- Slow release of essential nutrients to plants.

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- Marketing problems of organic inputs and outputs.
- Low yields during conversion.
- Lack of awareness among the growers.

Conclusion:

Flowers grown with conventional techniques contribute to the contamination of groundwater and streams through fertilizer and pesticides run-off, which can in turn impact wildlife and human health. But organic flowers are grown with consideration for the wildlife, farm workers, and ultimately the ground in which they are grown.

Since people don't consume flowers in the same way we consume food, we were more relaxed and tend to choose flowers grown in conventional practices. But with realization of the ill-effects caused by the conventional farming people are now drawn towards a change which is opting for organic flowers. As the concept of local is becoming more accepted in the floral industry, consumers are longing to purchase blooms that are fresh and non-toxic. As this demand spreads, so will chemical-free crops. This will greatly help the community of farmers, designers and florists, who work together throughout the year as seasons change.

The organic practices in floriculture is still in its nascent stage, yet the interest shown by the growers and consumers towards organic flowers, the industry promises a strong potential to the farmers and entrepreneurs alike.

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