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Study on use of organic, inorganic and Nano chemicals in *Hyacinth orientalis* cv. Fondant for augmenting propagation ratio

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Abstract
Study on use of integrated use of organicmanures, inorganic fertilizers and nano chemicals for augmenting propagation ratio in Hyacinth orientaliscv. Fondant was carried out at Farm of KVK Ganderbal during year 2018-19. The investigation involved a total of 12treatment combinations of organic manures viz. Vermicompost, FYM and Sheep manure @ 2 t/4 t/7 t per ha and nano chemicals viz.nano char and magic gel @ 50 g/m2 besides 90% of RDF to all treatments. Results of the study reveals that minimum days for bulb sprouting after planting (73.50cm) and days taken to third leaf appearance(92.00) was recorded in treatment T5:Vermicompost 3 t/ha + Magic Gelwhile as maximum days for the same 83.50 and 93.50 days respectively were observed with treatment T8: FYM 4t/ha + NANO char. From growth parameters point of view maximum plant height 23.30cm, leaf area758.90cm3, number of offsets per bulb3.00 and diameter of offsets14.19cm was found with treatment T9: Vermicompost 3 t/ha + NANO char while as minimum values for plant height 21.75cm,leaf area 730.30cm3, minimum number of offsets 2.33 and offset diamter10.15cm resulted with treatment T3 i.e. FYM 4t/ha + Magic Gel.

Keywords: Organic, inorganic, Nano, chemicals, ratio, *Hyacinth orientalis*

Introduction
Hyacinthus orientalis is one of the important temperate spring-flowering bulbous crop and belongs to family Hyacinthaceae. Hyacinth flowers are known for its fragrance and aesthetic look having single dense spike of fragrant tubular flowers in different shades ranges from red, blue, white, orange, pink, violet to yellow.*Hyacinth* bulbs are perennial in nature and lasts for 3 years as main bulb and formation of offsets on annual. Cost of bulb varies from Rs 50 to 100 in Delhi and other markets of India. Propagation ratio varies from soil to soil and nutritional status of a particular soil. Nutrient management plays an important role in enhancing propagation ratio of Hyacinth. What type of nutrient combination can give better yield of offsets is always a question mark. From scientific point of view organic manures proves good as far as nutrient supply to plant is concerned but at what ratio is always questionable. Nano chemical application in quality production is now a days a burning issue and its use in INM strategies can give better results. It also possesses an adequate exchange capacity to retain and supply the elements necessary for plant growth. Growing medium provides sufficient anchorage and support to the plant, serves as reservoir for nutrients and water, allow oxygen diffusion to the roots and permit gaseous exchange between the roots and atmosphere outside the root substrate. Magic gel absorbs and retains water (up to 400 times of its weight) and results prior germination with a healthy start while as Nano Char nano particle is produced from bamboo feedstock by anaerobic pyrolysis at 500-600 °C. It enriches the soil with enormous nutrients (K, Mg, Ca, Si, Mn, Zn etc) and serves as a nutrient reservoir. The increased surface area and adsorption capacity makes it highly applicable in agricultural field. It reduces the absolute fertilizer and periodic irrigation dependence. Very little work seems to have been done on use of nano chemicals in INM on bulbous crops particularly in Hyacinth for augmenting better productivity. Thus the study was undertaken to evaluate the influence of Nano chemicals in INM for quality propagation ratio in Hyacinth.

Materials and Methods
Investigation on use of organic, inorganic and Nano chemicals in *Hyacinth orientalis cv*. Fondant for augmenting propagation ratio was conducted during 2018-19 at KVK Ganderbal.

Ganderbal district is situated at 33.73°N 75.15°E and is at an average elevation of 1,950 m above mean sea level.

Experimental details

Twelve different treatment combinations were tested in the experiment including T_1: Vermicompost 2 t/ha + Magic Gel, T_2: Sheep manure 4t/ha + Magic Gel, T_3:FYM 4t/ha + Magic Gel, T_4: Vermicompost 3 t/ha + Magic Gel, T_5:Sheep manure 7t/ha + Magic Gel, T_6: FYM 7t/ha + Magic Gel, T_7:Vermicompost 2 t/ha + NANO char, T_8: Sheep manure 4t/ha + NANO char, T_9: FYM 4t/ha + NANO char, T_{10}: Vermicompost 3 t/ha + NANO char, T_{11}: Sheep manure 7t/ha + NANO char, T_{12}: FYM 7t/ha + +NANO char.

Preparation of beds for experimental trial

Field was prepared by ploughing followed by leveling. It was ensured removal to remove previous crop residue, weeds etc and beds measuring 1.00 m x 1.00 m for planting of bulbs were prepared. Organic manures treatment wise *viz*. farmyard manure (FYM), vermicompost, sheep manure were applied in the soil before the planting of bulbs. Magic gel and Nano char were applied during the soil preparation @ 50g per m^2 wherever applicable.

Observations recorded

Observations on Days to bulb sprouting, Days to third leaf appearance, Plant height at maturity (cm), Leaf area (cm^2), Leaf Area Index, Number of offsets per bulb, Weight of offsets (g).

Results and Discussion

Data depicts **(**Table 1) significant differences in the number of days taken to bulb sprouting among the treatments however minimum number of days (73.50 days) were recorded in treatment T_4: Vermicompost 3 t/ha + Magic Gel whereas the maximum 80.00 days taken resulted with T_{12}: FYM 7t/ha + +NANO char. Similar trend was followed in Days taken to third leaf appearance with minimum days (90.00) recorded with T_4: Vermicompost 3 t/ha + Magic Gel and maximum Days(93.00) received with T_{12}: FYM 7t/ha +NANO char. Results reveal that use of magic gel augmented bulb sprouting and leaf emergence. Magic hydrogel has properties of nutrient and water retention. Earliness in sprouting due to use of magic gel in integration with vermicompost could be due to adequate absorber property *viz*. absorbs and retains water (up to 400 times of its weight), optimizer and absorbs water and necessary nutrients. Early sprouting in media amended with different constituents was also reported by Lyngdoh *et al*. (2015) [7] during scale propagation in lilium. Better sprouting of bulbs of Amaryllis belladonna was also observed in medium containing mushroom compost in comparison to control i.e. simple soil (Bostan *et al*., 2014) [2]. Early vegetative growth in Vermicompost based medium was also reported by Sisodia and Singh (2015) [14] in case of gladiolus.

As evident from the findings of the investigation highest values for Plant height at maturity (cm) 23.00 cm, leaf area 758.90 cm2, Leaf Area Index4.58,,Number of offsets per bulb 3.00, Weight of offsets (g) 14.29 resulted with treatment T_{10}:Vermicompost 3 t/ha + NANO char whereas as minimum vales for Plant height at maturity 21.05 cm, leaf area 730.30 cm2, Leaf Area Index4.13,,Number of offsets per bulb 2.33, Weight of offsets (g) 10.15 were recorded T_3: FYM 4t/ha + Magic Gel.(Table 1 & Fig1,2,3,4.). Nano char enriches the soil with enormous nutrients and serves as a nutrient reservoir. The increased surface area and adsorption capacity reduces the absolute fertilizer and periodic irrigation dependence and plays important role due to its physical and chemical properties. Nano char augmenting plant height and subsequently resulted with maximum leaf area, leaf area index, number of propagules and weight of offsets could be due to high mineral content (K, Mg, Ca, Si, Mn, Zn etc.), Improves and stabilizes the pH by reducing the amount of H^+, Contamination Inhibitor, restricts the contamination of soil by pesticides and heavy metals, increases organic matter in the soil and micro spores help in sheltering the beneficial microbes from extreme temperature and retains moisture as well as desirable micro-nutrient by mitigating additional fertilizer and irrigation. Dominance of Vermicompost 3 t/ha + NANO char could be due to readily available nutrients, growth regulators, enzymes etc. two times more N, 2-3 time more P_2O_5, and K_2O as compared to FYM and sheep manure. In addition to this vermicompost is rich in Ca, Mg, Mo, Cu, Mn, etc. besides contain more plant growth promoting substances *viz* NAA, cytokinin, gibberellins etc. Vermicompost is known to play a multipurpose role in improvement of soil fertility through its influence on available soil NPK, electrical conductivity, organic carbon, pH as well as serves as a seat for proliferation of beneficial microbes which either helps in fixing nitrogen through biological processes or enhance availability of phosphorus through soliblization. Vasanthi and Kumaraswamy (1999) [16] observed higher values of soil in terms of available soil NPK and organic carbon by incorporation of vermicompost. Chowdappa *et al*. (1999) [4] recorded considerable higher microbial population and higher levels of macro and micro nutrient in vermicompost. Soil bacterization with organics improves quality and yield (Subba Rao, 1982 and Narula *et al* 1989) [15, 8]. Organic inoculation improve yield and quality of produce by nitrogen fixation apart with enhance uptake of Fe, Zn, Cu and Mo (Awasthi *et al*, 1998) [1]. Available soil phosphorus enhances the uptake of phosphorus which in turn led to high crop yield (Gaur, 1990; Vendan and Subramanian, 2000) [5, 17]. Early and improved vegetative growth in FYM based medium was also reported by Chaudhary *et al*. (2013) [3] in case of gladiolus. Similar results were also observed by Gupta *et al*. (2008) [6] and Kukde *et al*. (2006) in tuberose. Increased bulb size in media amended by various substrates has been reported by Nikrazm *et al*. (2011) [9] in lilium. Pronounced effect due to application of farmyard manure has also been well documented by Singh and Jauhari (2005) [12] and Singh (2006) [13]. Increased bulblet multiplication could again be attributed to higher translocation of carbohydrates to the underground portions contributing more towards bulb growth and bulblet multiplication in the medium. Current findings are also supported by Singh (2002) [11] in Asiatic cultivars and Sharma *et al*. (2007) [10] in Oriental lilies.

Table 1: Study on Use of organic, inorganic and Nano chemicals in *Hyacinth orientalis* Cv. Fondant for augmenting propagation ratio.

Treatment	Days Taken to Bulb Sprouting (DAP)	Days Taken To Third Leaf Appearance (DAP	Plant Height (Cm)	Leaf Area (Cm^2)	Leaf Area Index	Number of Offsets Per Bulb	Weight of Individual Offset (g)
T_1= Vermicompost 2 t/ha + Magic Gel	76.50	95.50	21.72	735.60	4.30	2.43	10.37
T_2= Sheep manure 4t/ha + Magic Gel	78.00	93.50	21.65	732.30	4.14	2.33	10.25
T_3= FYM 4t/ha + Magic Gel	78.00	93.00	21.05	730.30	4.13	2.33	10.15
T_4= Vermicompost 3 t/ha + Magic Gel	73.50	90.00	21.90	745.60	4.39	2.47	10.47
T_5= Sheep manure 7t/ha + Magic Gel	75.50	92.50	23.00	735.30	4.17	2.36	10.35
T_6= FYM 7t/ha + Magic Gel	75.00	92.50	22.25	735.30	4.17	2.36	10.35
T_7= Vermicompost 2 t/ha + NANO char	82.50	93.00	23.05	752.10	4.49	2.55	13.10
T_8= Sheep manure 4t/ha + NANO char	83.00	93.50	22.60	742.10	4.23	2.47	12.30
T_9= FYM 4t/ha + NANO char	83.50	93.50	22.40	741.90	4.19	2.46	12.21
T_{10}= Vermicompost 3 t/ha + NANO char	79.50	91.00	23.30	758.90	4.58	3.00	14.29
T_{11}= Sheep manure 7t/ha + NANO char	80.50	93.00	22.40	745.10	4.53	2.78	13.21
T_{12}= FYM 7t/ha + +NANO char	80.00	90.50	22.90	745.10	4.53	2.75	13.18
C.D. ($p \leq 0.05$)	1.28	1.48	0.70	1.53	0.04	0.17	0.48

DAP= Days after planting
*90% RDF common to all treatments except control

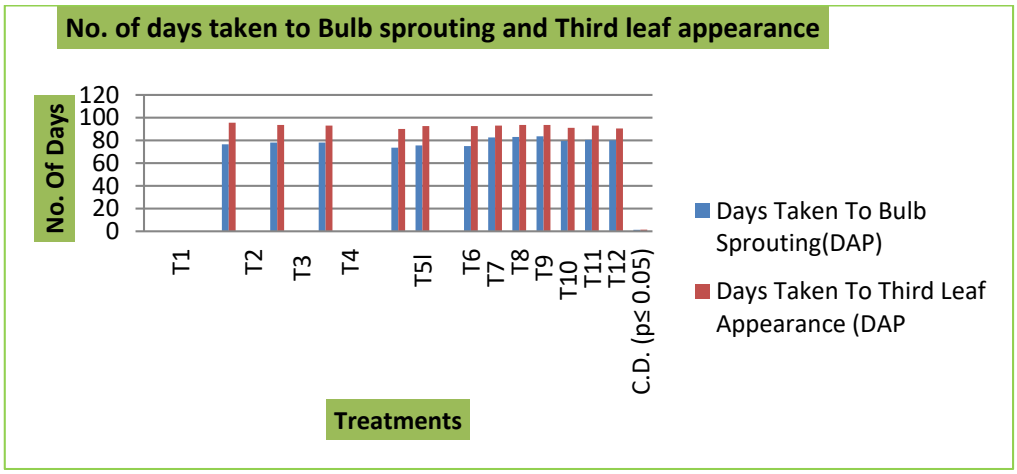

Fig 1: Showing No. of days taken to Bulb sprouting and Third leaf appearance

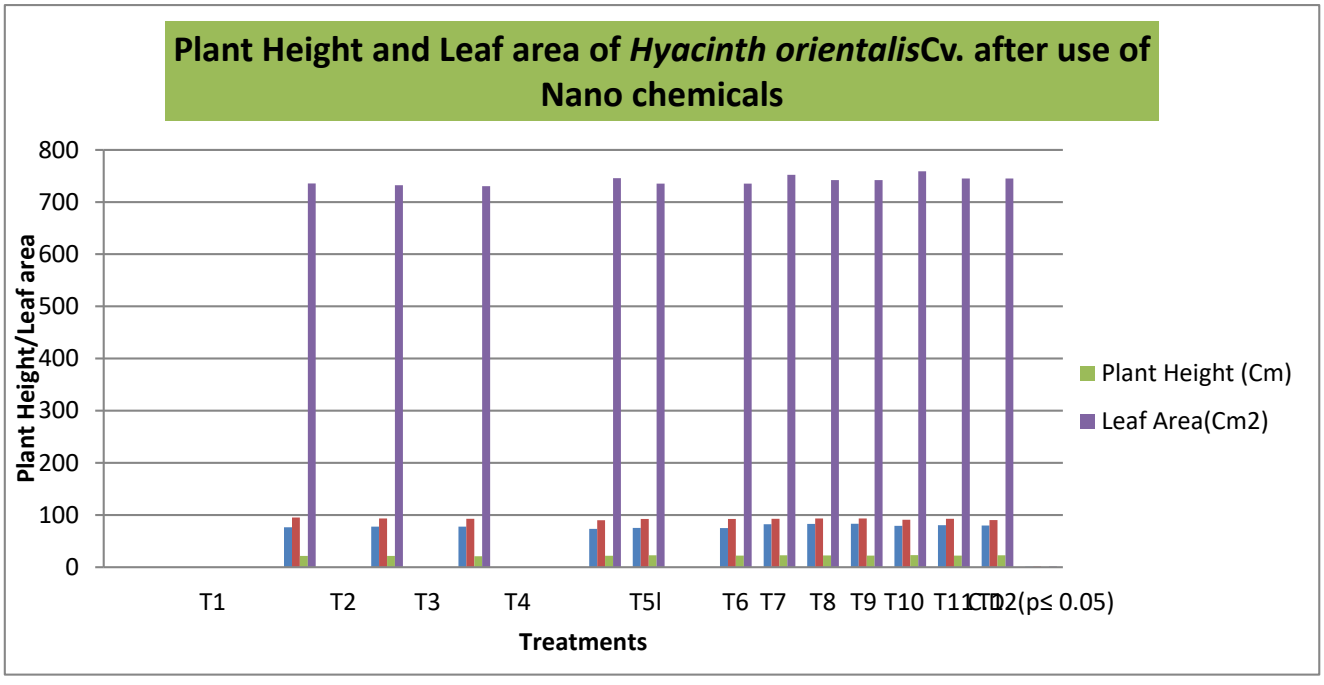

Fig 2: Showing Plant Height and leaf area of Hyacinth orientalisCv. after use of Nano chemicals

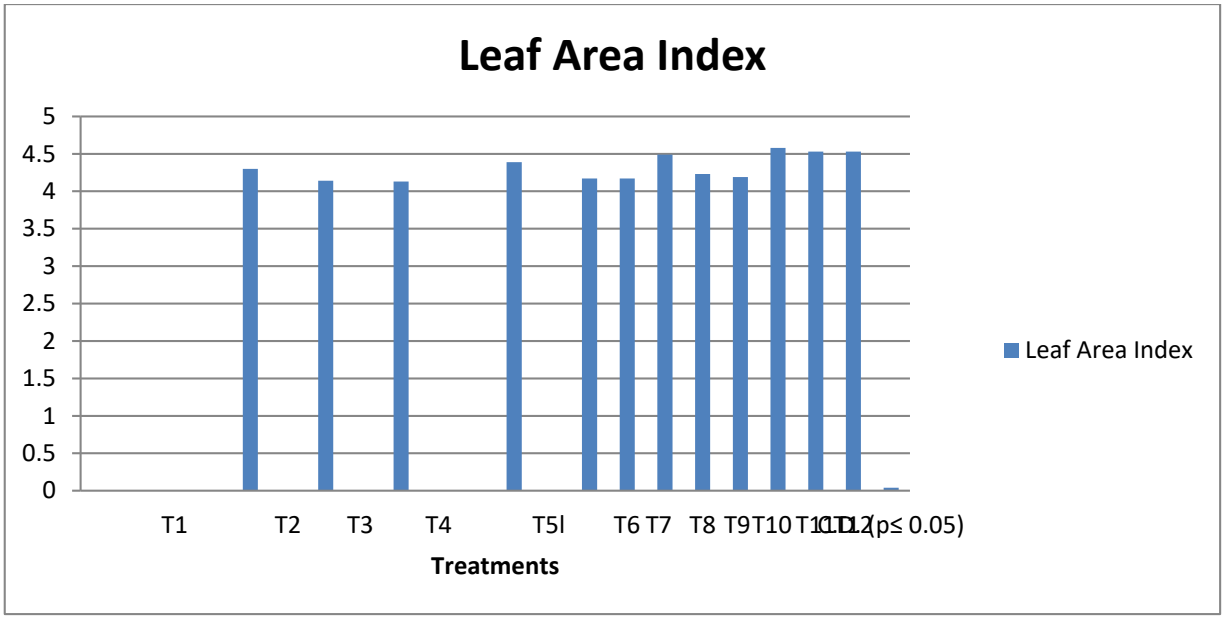

Fig 3: Leaf areaIndex of Hyacinth orientalis Cv. after use of Nano chemicals

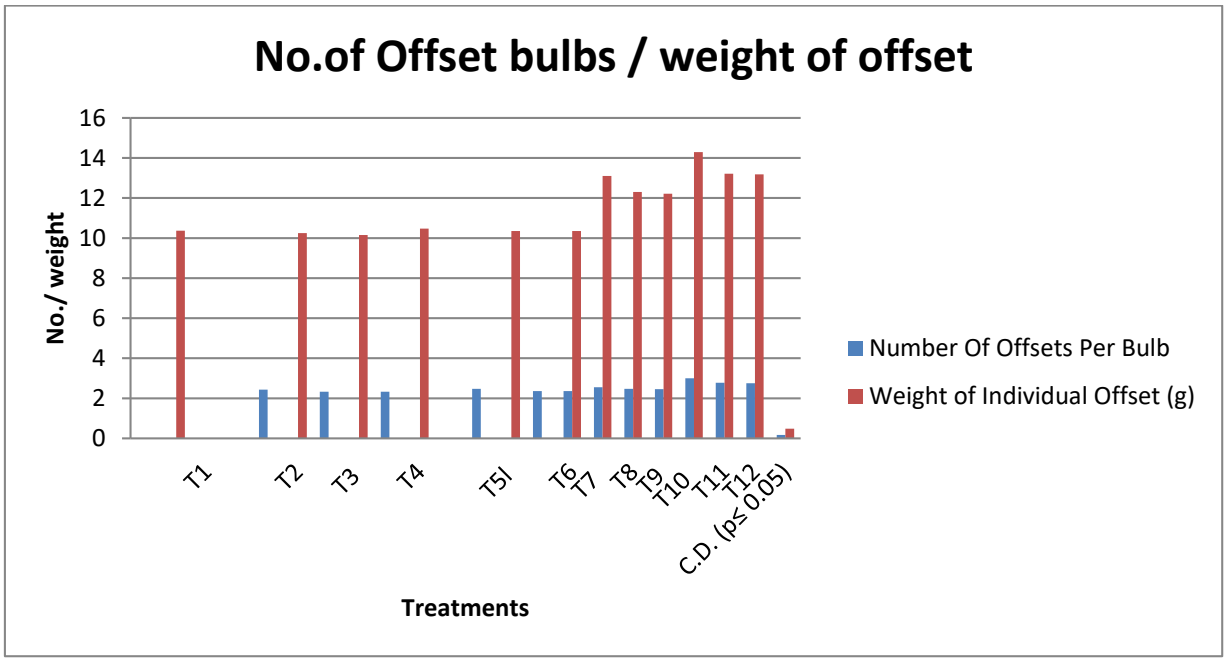

Fig 4: No. of offset bulbs/weight of offset of Hyacinth orientalisCv. after use of Nano chemicals

Summary and Conclusion

Based upon the studies conducted it is concluded that different media combinations have profound effect on growth and development of *Hyacinthus orientalis* Cv. Fondant and among all the tested treatment combinations Vermicompost 3 t/ha + NANO char proved best in propagule production.

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