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Effect of Gibberellic Acid (GA_3) , Synder and Growing Media on Seedling Growth of Papaya (*Carica papya* L.) cv. Pusa Nanha

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Abstract
This experiment was conducted as "Effect of Gibberellic acid, synder, and growing media on seedling growth of papaya (*Carica papaya L.)* cv. Pusa Nanha". In this study the tratments comprised with different combinations of soil , FYM, and vermicompost and synder with different levels of GA3. Experiment was laid out in Factorial Complete Randomized Block Design. The findings showed that GA3 200ppm is found most effective for better root growth parameters , shoot growth (height of seedling, number of leaves, girth of seedling , average leaf area) and survival percentage. Among the different growing media , the growing media combination , soil + FYM + vermicompost (1: 1: 1) observed higher values for root growth parameters.

Keywords- Farm yard manure, Vermi-compost, soil and gibberellic acid (GA3) , synder

Introduction
Papaya is tropical fruit crop, botanically known as Carica papaya L. and belongs to the Caricaceae family. It originated from tropical America (Hafmer, 1990) that was introduced in India during 16th century from Malacca (Kumar and Abraham, 1983) . Papaya occupies about 2.0 percent of total fruit cropped area and 5.3 percent of total fruit production in India. It occupies a cultivated area of about 126.0 thousand ha with an annual production of 5508.0 thousand MT with average productivity of 43.7 MT/ha (Anonymous, 2016) . It is generally propagated by seed (Cheema and Dhani, 1990) and it is interested by the researchers due to the presence of gelatinous sarco-testa preventing germination and dormancy. Gibberellins act in the mobilization of seed reserves during the germination process. Therefore, GA3 considered as important germination promoter which increased the seed germination of papaya (Zanotti and Barros, 2014) . Growing media plays an important role in seed germination and subsequent vegetative growth of seedlings (Srivastava et al., 1998) . Media not only acts as a growing place but also as a source of nutrient for plant growth. The soil is usually used as a basic medium because it is cheapest and easy to procure (Bhardwaj, 2013) . Vermicompost provides sufficient levels of oxygen to roots, adequate storage of water and nutrient for the plants. FYM (farm yard manure) is having good water holding capacity as well as sufficient porosity which increase the growth of the plant by providing good environmental condition. Synder is often economical to use ash as a soil amendment. The potential of synder as a resource material in agriculture is due to its specific physical properties like's texture, water holding capacity, bulk density, pH etc., and contains almost all the essential plant nutrients.

Materials and Methods

The experiment was carried out at Shade net house, Department of Hoticulture , Sam higginbottom University of Agriculture and Technology Sciences Naini , Prayagraj. This trial was laid out in Factorial Complete Randomized Block Design. The experiment comprised of 9 treatments which was the combination of GA3 and growing media and synder. The growth promoter like Gibberellic acid (GA3) was used as presoaking solution for 12 hours with three concentrations i.e. GA3 100 ppm, 150 ppm, 200 ppm and Control as water soaking of seeds and different growing media used in different ratio Soil as control, Soil: FYM (1:1), Soil: Vermicompost (1:1)

Results and Discussion

Effect of GA_3: Germination increased in seeds desiccated in the shade and treated with gibberellic acid, while average time of germination decreased with the increase of the desiccation time in the seeds deprived of sclerotesta and treated with GA_3. At the 60 days after sowing (DAS) the plants observed the maximum number of primary roots (6.42), maximum number of secondary roots (25.00), longest primary roots (9.65 cm), longest secondary roots (3.56 cm), highest fresh weight of roots (2.49 g) and highest dry weight of roots (0.24 g) observed which has presoaking treatment with G3 (GA_3 200 ppm). The minimum root/shoot ratio (0.51) was observed in treatment G2 (GA_3 150 ppm) andMaximum root/shoot ratio (0.56) was found in G3 (GA_3 200 ppm). This might be due to the fact that, vigorous root growth due to GA3 might have resulted in more production of photosynthetic product and their translocation through phloem to the root zone, which might be responsible for improving the root growth. The findings are supported by Dhankhar et al., (1997)[8] . The different shoot growth parameters such as height of the plant, number of leaves per plant, girth of seedling, average leaf area, fresh weight of shoot and dry weight of shoot of seedling were found significant which enhanced by GA3 applications. But chlorophyll content (SPAD Value) of seedling was recorded non-significant (Table 3&4). The maximum plant height (11.08 cm), maximum number of leaves per plant (9.78), maximum girth of seedling (3.58 mm) and largest average leaf area (37.50 cm2) were found in treatment G3 (GA_3 200 ppm). This may be attributed due to the reason that the endogenous levels of GA_3 synthesized by the papaya seedling might not be sufficient and external application of GA_3 might have boosted growth by increasing cell multiplication and cell elongation resulting in better plant growth.

Growing Media: The effect of three types of media and three levels of cocopeat were studied under shadenet conditions on germination and development of papaya seedling in a Complete Randomized Design with nine treatment combinations. The results showed that the medium of vermicompost + soil + synder (1 : 1 :1) with 2 cm cocopeat on the top (T9) gave maximum speed of emergence, highest germination percent , highest seed vigour , maximum germination index , germination value and least time required for imbibtion (9.45 and 9.30 days) with minimum germination period (3.70 and 2.75 days), respectively. This medium was also found to be the best medium for the growth of papaya seedlings as it gave the highest parameters in terms of seedling height, leaf area , number of leave, stem girth , number of roots , root length , production and least root/shoot ratio (0.22 and 0.20). This treatment also significantly reduced the seedling mortality and produced maximum healthy seedling.

The data directs significant results with various root parameters. The maximum number of primary roots (7.67), maximum number of secondary roots (27.67) and longest secondary roots (3.86 cm) were observed in treatment combination, G3M3 [Soil + Vermicompost + synder (1:1:1) + GA3 200 ppm]. Interaction of GA3 and growing media were also significantly enhanced fresh and dry weight of roots. Highest fresh weight of roots (2.89 g) and highest dry weight of roots (0.29 g) were also recorded with the treatment

combination, G3M3 [Soil + Vermicompost + FYM (1:1:1) + GA3 200 ppm]. While, length of primary and root/shoot ratio were observed non-significant. In root growth parameters the overall growth might be improved due to synergistic effect of media and GA3, media helps to provide better water holding capacity, porosity, soil aeration and supplying substantial amount of nutrient specially nitrogen and micro nutrients for the proper growth of roots (Chopde et al., 1999; Edwards, 1998) and GA3 might have increased the physiological activities of seedlings, essential for cell division or cell enlargement or both, because growth of the plant occurs by two processes i.e. cell division by mitosis which adds new cells and elongation of already existing cells by enlargement of the vacuole . The various shoot parameters have significant results. The maximum plant height (12.73 cm), girth of seedling (3.83 mm), maximum average leaf area (38.38 cm2), fresh weight of shoot (5.04 g) and dry weight of shoot (1.25 g) were observed in media combination G3M3 [Soil + Vermicompost + synder(1:1:1) + GA3 200 ppm]. Because, GA3 stimulate the cambium and its immediate cell progeny by the process of enhancing the rate of cell multiplication. The rate increase in the dimension of the cell both in pith and cortex region is faster than number of cells per unit area resulting better shoot growth (Agha et al., 1990) and a appropriate media mixture provides better root environment to the plant leading to better nutrient availability to the photo synthetically functional leaves that ultimately utilized for shoot growth promotion (Borah et al., 2007) [4]. However, the number of leaves and chlorophyll content had result non-significant. The maximum survival percentage (90.67%) was recorded in the treatment combination, G3M3 [Soil + Vermicompost + FYM (1:1:1) + GA3 200 ppm]. This might be due to GA3 which helps in cell expansion and its elongation resulting better root and shoot growth, which supports and encourage better survival of the seedlings (Rahangdale, 2015) .

Synder: Using synder in home gardens can increase soil fertility and raise soil pH. Potential benefits of synder contains nutrients that can be beneficial for plant growth. Calcium is the plant nutrient most commonly found in synder and may comprise 20% or more of its content.

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