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Effect of NPK on various soilless and soil-based substrates on the growth, yield and quality of Zinnia (*Zinnia elegans* L.)

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Abstract

Zinnia (*Zinnia elegans*) is a wonderful summer annual flower belongs to Asteraceae family. In Pakistan, different types of media are using for zinnia from many years. The appropriate potting media is vital for quality flower production as it play important role in the uptake of nutrients by enhancing root development. It is cultivated in many types of soils, soil combinations or with the adding of organic matter and materials without soil that may include sand. Nutrients, Nitrogen, Phosphorus & Potassium play an important role in the production of good quality flowers. Nitrogen is essential for the creation of biomass along with the bio synthesis of enzymes in the crysanthemum leaves. Chrysanthemums take up nitrogen at a uniform rate from the time of planting to the flowering stage and after that time nitrogen uptake decreases. Phosphorus is a key component in the development of high vitality mixes, for example, AMP, ADP and ATP, adding to improve yield and nature of harvests, assuming fundamental job in photosynthesis and breath. It is fundamental for vitality change in plant cells, cell division, advancement of meristem tissue, early root improvement, blossoming and seed improvement. Results shown that maximum flowering duration (34.6 days) were recorded in plant grown in Soil + PM media, which was statistically similar to Soil + CC media having flowering duration of 34.3 days, while minimum flowering duration (27.2 days) were recorded in plant grown in sand substrate, which were statistically similar to Soil + Sand media.

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Introduction

Zinnia (*Zinnia elegans*) is a wonderful summer annual flowering plant belongs to the family of Asteraceae (Khan *et al.*, 2013). This plant gained quick status for its bright unusual blossoms and strong stems with virus safe plants and lengthy vase life (Sardoei *et al.*, 2014). There are 20 species in the genus Zinnia and Zinnia elegans is most common (Stephen, 2004).The dwarf varieties of zinnia are planted in containers and window planters (Singh and gupta 1995). The stature of Zinnia is around 76cm with lone daisy like blossom heads and spear formed leaves. The beam blooms are purple, the circles yellow and dark; the whole head is around 2 inches (10cm) in distance across and some with blossom goes to 6 inches (15cm) over. Zinnias are twofold, semi-twofold and dahlia-like blooms which are hardy and with stand to abiotic stress (Javid *et al.*, 2005). It is commonly used for flower beds making clumps (Riaz *et al.*, 2011). Bitter growth and flower production usually depends upon various factors including nutrients availability and the type of growing media used.

In Pakistan, different types of media are using for zinnia from many years. The appropriate potting media is necessary for quality flower production as it play role in the uptake of nutrients by enhancing root development (Awang, *et al.*, 2009).

For more than 30 years of compartment generation cultivation crops are for the most part reliant on soilless culture which have source of both organic and inorganic constituents. Because they are disease and pests free, very light in weight, and very good moisture and nutrient holding capacity. Moreover, they possess good air spaces, offers the bitter space for rooting necessary for plant growth and provides stable physical and chemical properties. All these properties ensure bitter quality and production of ornamental plants (Selda and Omer, 2010). The development and nature of bloom is impacted by various ecological viewpoints like soil type and the supplements accessibility and these are the most basic variables for better development.

The discretionary portion of nourishment can guarantee typical development as sustenance is a significant factor which is legitimately identified with development and blossoming (Younis *et al.*, 2014). Composts are commonly applied to improve the harvest yield, healthful quality and tasteful estimation of yields (Sikander *et al.*, 2009). Nitrogen, Phosphorus and Potassium assume a significant job in the generation of good quality blooms (Jana and Pal 1991). Nitrogen is basic for the formation of biomass alongside the bio amalgamation of chemicals in the crysanthemum leaves (Liu *et al.*, 2010).

Chrysanthemums take up nitrogen at a uniform rate from the hour of planting to the blossoming stage and after that time nitrogen take-up diminishes (Yoon *et al.*, 2000). Phosphorus is a key component in the development of high vitality mixes, for example, AMP, ADP and ATP, adding to improve yield and nature of harvests, assuming basic job in photosynthesis and breath. It is essential for vitality change in plant cells, cell division, advancement of meristem tissue, early root improvement, blossoming and seed advancement (khan, 2013). The impact of potassium on plant development and yield generation and making opposition impermanent dry spell, guideline of chemicals action expanding the power of photosynthesis accelerate the exchange of materials made during the procedure of photosynthesis (Haghghi *et al.*, 2011). Potassium has been accounted for to be associated with combination of peptide security, protein and sugar digestion and furthermore contributes in quick cell division and separation. Phosphorus and potash substance brought about most extreme increment in supplement take-up by prudence of more photosynthesis through more chlorophyll development with an expanded leaf region (Belorkar *et al.*, 1992). In this manner, the goals of present research to assess the advancement of zinnia by various portions of NPK in soil based and soilless media performed with the accompanying destinations.

Material and methods

The present research was conducted in research field area of department of Horticulture, at Pir Mehr Ali Shah Arid Agriculture University Rawalpindi, during

the year 2018. Seedlings were arranged from department of Floriculture NARC. Seedlings were transferred into pots which were filled with soils of different compositions. Coconut coir and peat moss were bought from green impex Islamabad while farm yard manure is bought from a local dheri farm the farm yard was old and clean and was ready for the growing purposes. Seedlings were at 2-3 leaf stage. Sufficient moisture was provided carefully. The thinning was performed by placement of the strong seedlings. Fertilizer sources used for nitrogen, phosphorous and potassium were urea, single super phosphate and sulphate of potash respectively. 1st dose was given after one month of transplanting, second after 15 days interval and last at time of flower bud initiation. Irrigation was done on regular basis.

Statistical analysis

The experiment was set down by using linear model randomized complete block design (RCBD). The collected observations were evaluated using Statistix 8.1. The means were compared by using Least Significant Difference (LSD) at 5% probability level (Steel *et al.*, 1997). The experiment was consisted of two factors: Factor A-Zinnia: and Factor B-three different media.

Parameter under study

So as to appraisal the effect of numerous groupings of NPK and various media on the Zinnia plant's vegetative and gainful parameters (plant height, leaf area, number of leaves stem diameter, root length and lateral length). The conceptive parameters are as neglected; number of days taken to flowers, blossom size, number of flowera and flower duration (days).

Results and discussion

Vegetative growth parameters as affected by different quantities of NPK and different medias on zinnia.

Plant height (cm)

The collaboration among various growing media and NPK stages was also important. Maximum plant height (43.1cm) was recorded in plant which received highest level of NPK at 30g/pot, followed by NPK at 20g/pot. The mean data revealed that maximum plant height (48.7cm) was recorded in T2F3 (Soil + PM +30 NPK), followed by T4F3 and T3F3 having plant height of (44.7cm). While minimum plant height (27.5cm) was recorded in T7F1 (Sand + 0 NPK). The reason of maximum height in T2F3 is due to the fact of that major nutrients are available to the plant which resulted in increased plant growth.

Due to increased cell division and enlargement and conversion of photosynthesis, plant growth accelerated. The reason of maximum height in T2F3 is due to the fact of that major nutrients are available to the plant which resulted in increased plant growth. Because of expanded cell division and extension and transformation of photosynthesis, plant development quickened. NPK affect plant development and advancement (Abbas *et al.*, 2009).

Phosphorous is essential for some, life procedures, for example, photosynthesis, amalgamation and breakdown of starches and move of vitality with in the plant (Obreza, 2001) Nitrogen is a compost that is utilized generally and is vital for the creation of a large portion of the segments of cell (Huber and Thompson, 2007).

Peat greenery was answerable for increment in stature of plant when contrasted with coconut coir and similar outcomes were found by Tehranifer *et al.*, (2007) who assessed that various media types have impacts on vegetative development properties of strawberry, so media that contain peat greenery in that the plant tallness was high likewise same outcomes were given by Cantliffe *et al.*, (2007).

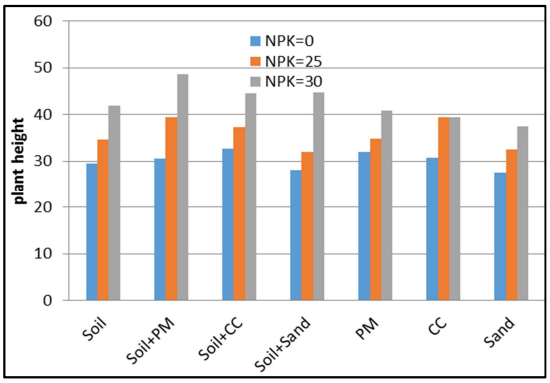

Fig. 1. Plant height of Zinnia as affected by NPK levels and different growing media.

Number of leaves

The measurable examination of the information indicated that diverse developing media and NPK levels have noteworthy impact on number of leaves. The association was additionally huge. Most extreme number of leaves (24.95) were recorded in plant which got most elevated level of NPK at 30 g/pot, trailed by NPK at 20 g/pot. While least number of leaves (16.33) were recorded in charge. Number of leaves were greatest (23.67) in plant developed in soil + peat greenery media, which was factually like soil +coconut coir media, while least number of leaves (18.7) were recorded in plant developed in sand substrate. The mean information for connection shows that most extreme number of leaves (27.66) was recorded in T2F3 (Soil + PM +30 NPK), which was factually like T3F3 (Soil + CC + 30 NPK) having 26 number of leaves plant-1. While least number of leaves (13.6) was recorded in T7F1 (Sand + 0 NPK).

T_2F_3 occupied the highest position in these results, indicating the role of fertilizers for vegetative growth. This is so because nitrogen has capability to rise number of cells, cell dimension and leaf creation. Reason of less number of leaves is due to insufficient nitrogen which helps leaf in its bud initiation and also the reason for increase of number and length of leaves in tuberose is increasing of nitrogen.

The ideal impact of nitrogen in advancing number and length of leaves may be because of the way that nitrogen is essential piece of protein and part of cellular material which increment the chlorophyll substance in leaves. This capacity prompted cell duplication, cell augmentations and cell separation which have brought about expanding of number and length of leaves (Chaudhary, 2007). Verma *et al.*, (1996) demonstrated that nitrogen supply is associated with the use of carbohydrates, improved protein synthesis allowing crops to grow more rapidly rapid metabolism, cell division, cell elongation and stimulates both apical development and leaf formation.

Tehranifer *et al.*, (2007) in his study on strawberry revealed that maximum numbers of leaves are found in various cultivars of strawberry plants developed in media containing peat greenery. Fym likewise demonstrated successful in increment of leaves number yet was non-critical. This was additionally found by Ahmed *et al.*, (2004) in dahlia blossom.

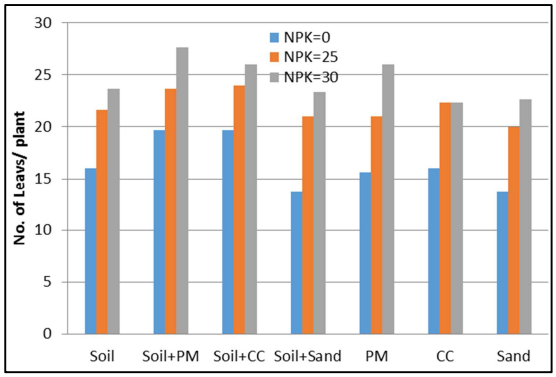

Fig. 2. Number of leaves plant^{-1} of Zinnia as affected by NPK levels and different growing media.

Leaf area (cm²)

The mean data (table-4.3) shows that maximum leaf area (35.4 cm²) recorded in plant which received highest level of NPK at 30 g/pot, followed by NPK at 20 g/pot. While minimum leaf area (23.19cm²) in control. Leaf area was maximum (33.3) in plant grown in soil + peat moss media, which was statistically similar to Soil + CC media, while minimum leaf area (25.3cm²) recorded in plant grown in sand substrate. The mean data for interaction showed that maximum leaf area (41.3cm²) was recorded in T2F3 (Soil + Peat moss +30 NPK), which was statistically similar to T3F3 (Soil + Coconut coir + 30 NPK) having 41.3 cm² of leaf area. While minimum leaf area (19.3 cm²) was recorded in T7F1 (Sand + 0 NPK).

Leaf area is the key content necessary for reproductive and metabolic parameter as the flow of food and other necessary enzymes takes place via plant leaves, maximum leaf area supports this flow beside increased photosynthetic rates.

Potassium has likewise been accounted for to be engaged with combination of peptide security, and protein and starch digestion, and furthermore takes part in fast cell division and separation (Belorkar *et al.*, 1992). Farm yard manure had provided maximum nutrients necessary for leaf growth while the sand has provided required water for maintaining turgor

pressure that significantly increasing leaf area. These findings are similar to Umar *et al.*, (2009) in strawberry and by Akparobi, (2009) in Ameranthus cruentus, Tariq *et al.*, (2013) in strawberry plants where sand + FYM was used as media.

Coconut Coir and peat moss are considered as best growing media for increased leaf area and vegetative growth of the leaves which is followed by fym, sawdust, sand and soil that show very small differences from treatments showing the highest values. The above studies shows that coconut coir only or in grouping with extra media like sand produce longer leaves which results in greater leaf area. Due to maximum leaf area photosynthesis increases, which in contrast also increase the production of food which results in increase of growth of plant. Another cause for increased leaf area is the increased root length because when root absorbs more amounts of nutrients from the soil which will result in larger leaf area (Ananda & Ahundeniya, 2003).

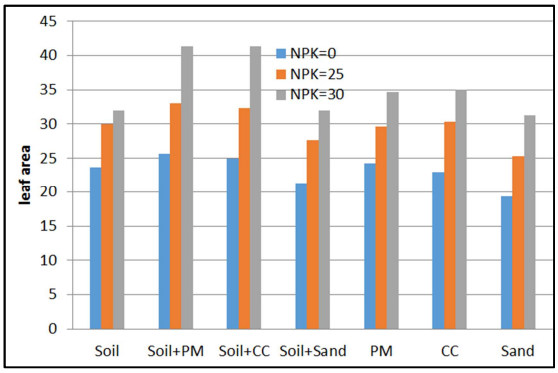

Fig. 3. Leaf area (cm²) of Zinnia as affected by NPK levels and different growing media.

Stem diameter (mm)

Maximum stem diameter (9.34mm) was recorded in plant which received highest level of NPK at 30 g/pot, followed by NPK at 20 g/pot. While minimum stem diameter (6.19 mm) was recorded. Means of different media revealed that, maximum stem diameter (9.14mm) was recorded in plant grown in Soil + PM media, which was statistically similar to Soil + CC media having diameter of 9mm, while minimum stem diameter (6.06 mm) recorded in plant grown in sand substrate. The mean data for interaction showed that maximum stem diameter (11.43 mm) was recorded in T2F3 (Soil + PM +30 NPK), followed by T3F3 having stem diameter of (10.66mm). While minimum stem diameter (4.73mm) was recorded in T7F1 (Sand + 0 NPK). Bergmann (1992) in a study reported that rise in stem diameter is because of the fact that nitrogen, phosphorus and potash is used in most of the enzyme reactions which happen in cells and hence has a functioning influence in the digestion of energy and thus increases the stem diameter.

Omotoso & Shittu (2007) detailed that the manure NPK fundamentally increment development parameters, yield and yield segments been higher in medications that got 300 NPK kg/ha while the use of 250 kg/ha of NPK gave the most elevated number of leaves and stem size (Awodun *et al.*, 2007).

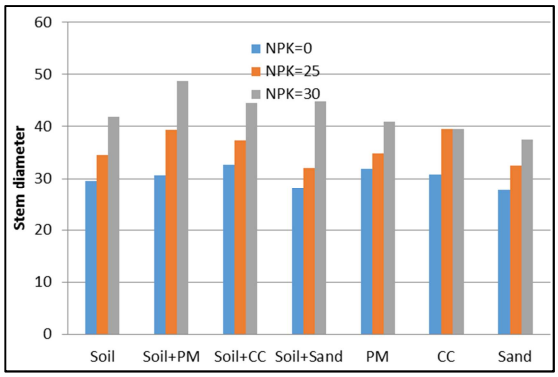

Fig. 4. Stem diameter (mm) of Zinnia as affected by NPK levels and different growing media.

Root length (cm)

The mean data (table-4.5) showed that maximum root length (11.42 cm) was recorded in plant which received highest level of NPK at 30 g/pot, followed by NPK at 20 g/pot. While minimum root length (7.24cm) was recorded in control. Maximum root length (10.98cm) was recorded in plant grown in Soil + CC media, which was statistically similar to Soil + PM media, whereas minimum root length (8.04cm) were recorded in plant grown in sand substrate , which were statistically similar to Soil + Sand, CC, PM and soil media. The mean data for interaction shows that maximum root length (14.8 cm) was recorded in T3F3 (Soil + CC +30 NPK), which was statistically similar to T2F3 (Soil + PM + 30 NPK) (13.5cm) followed by T5F3 (Peat moss + 30 NPK) and T1F3 (Soil + 30 NPK) having 10.63cm and 10.6cm of root

length. However minimum root length (5.6cm) was recorded in T5F1 (PM + 0 NPK) which was statistically similar to T6F2 (CC + 20 NPK) and T4F1 (Soil + Sand + 0 NPK).

Aeration increases the concentration of oxygen in the growth media, which is a significant factor in the impact of root morphogenesis and the effective absorption of water and nutrients that could have encouraged better root development (Gibbs & Greenway, 2003; Morard *et al.* 2004).

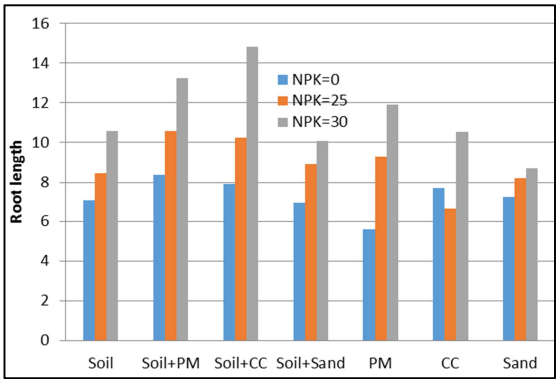

Fig. 5. Root length (mm) of Zinnia as affected by NPK levels and different growing media.

Number of lateral shoots

The results of numbers of horizontal shoot are given in graphs. The statistical study of the facts showed that different growing media and NPK levels have significantly pretentious number of lateral shoot. The interaction between NPK levels and different growing media was also significant. Maximum numbers of lateral shoots (5.57) were recorded in plant which received highest level of NPK at 30 g/pot, followed by NPK at 20 g/pot. While minimum number of lateral shoots (3.57) recorded in control. Maximum number of lateral shoots (5.77) were recorded in plant grownup in Soil + PM media, which was statistically similar to Soil + CC media having 5.3 total lateral shoots, whereas minimum number of lateral shoots (3.55) were recorded in plant grown in Sand + Soil substrate, which were statistically similar to plants grown on Sand media.

The mean records for collaboration shows that maximum number of lateral sprouts (7.66) were recorded in T2F3 (Soil + Peat moss +30 NPK), which was statistically similar to T3F3 (Soil + Coconut coir + 30 NPK) having 7 number of shoots, which is followed by T5F3 (Peat moss + 30 NPK). However minimum numbers of lateral (2.33) was recorded in T4F1 (Soil + Sand + 0 NPK), which was statistically similar to T7F1 (Sand + 0 NPK) and T5F1 (Soil + PM + 0 NPK).

High nitrogen with sufficient portions of phosphorus and potassium seemed to have upgraded vegetative advancement as Denisen (1982) expressed beforehand. Consequently, the fair use of these supplements prompted higher measure of parallel shoots (Samoil kenkoi, 1983).

Results indicate the increase in branching with increase in plant height, which in turn was affected by the rate of nitrogen application. Positive correlation was found between crop height, branching, and nitrogen application frequency, as evidenced by John *et al.* (1991) results that increasing nitrogen application from 0 to 150kg per hectare improved branching in Zinnia.

Riaz *et al.*, (2008) in a an investigation that the biggest development parameter esteems as measure of leaves per plant, plant stature and number of side branches that were extensively more noteworthy than every single other medium regarding measure of leaves per plant and number of side branches yet the measure of leaves per crop was not altogether with residue as far as plant tallness and measure of side branches per plant, the remainder of the media shifted non fundamentally among themselves.

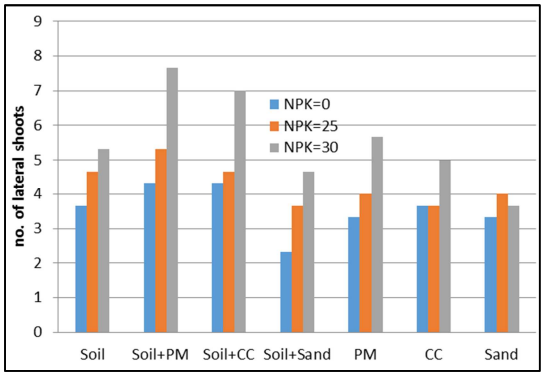

Fig. 6. Number of lateral shoot of Zinnia as affected by NPK levels and different growing media.

Length of lateral (cm)

The interaction was non-significant. Maximum length of lateral (23.14cm) were recorded in plant which received highest level of NPK at 30 g/pot, followed by NPK at 20 g/pot. While minimum lengths of lateral (15.26 cm) were recorded in control. Maximum length of lateral (21.34) was noted in plant grown in Soil + PM media, which was statistically similar to Soil + CC media, while minimum length of lateral (17.68 cm) were recorded in plant grown in Sand + Soil substrate , which were statistically similar to plants grown on Sand media. The mean data for interaction showed that length of lateral (26.13cm) was recorded in T2F3 (Soil + PM +30 NPK), followed by T3F3 having length of lateral of (24.46cm). While minimum length of lateral (15.03 cm) was recorded in T7F1 (Sand + 0 NPK). Generative development parameters as affected by different doses of NPK and different Medias on zinnia.

Nitrogen application alone gives increased size of canopy because it shows significant role in vegetative growing of plant i.e. more height, more numbers of leaves and additional branches. When nitrogen application is less then there will be less vegetative growth. Most of the vegetative characters i.e. plant height, number of leaves and spread of plant or length of laterals were enhanced with use of nitrogen, phosphorous and potash. Amin *et al.* (2015) showed in his study that study of variance shows that nitrogen, potassium and phosphorous as well as their collaboration has significant effect on plant canopy or number of laterals.

Width of the plant increase significantly as the doses of fertilizers increases. Plant height, plant spread and number of shoots per plant were also increased with the application of higher doses of NPK in rose.

It was observed that growing zinnia under various media was the best treatment in relation to development of side branches plant-1 and decrease in light resulted in a significant ($P<0.05$) decrease. Restricted daylight for particular hours and the plants developed more side branches as compared to natural organic manure. However, curtailing to showed adverse effects on the plants vegetative growth and in result sprouting of side branches was checked. Study is in pursuance with (khan *et al.*, 2007).

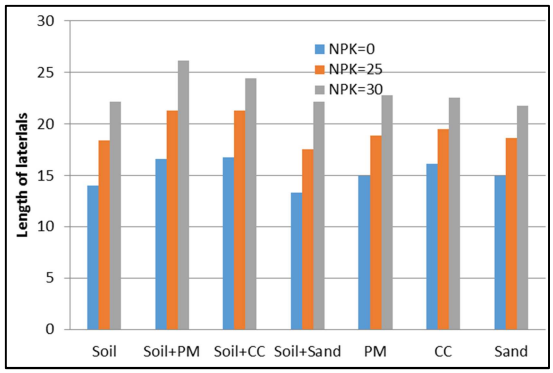

Fig.7. Length of lateral (cm) of Zinnia as affected by NPK levels and different growing media.

Number of days taken to flower (days)

The interaction between NPK levels and different growing media was also important. Maximum days occupied flowering (63.3 days) were recorded in plant which received highest level of NPK at 30 g/pot while least days to flowering (55.8 days) were recorded in plants which received NPK at 20kg ha^{-1}. Days to flowering was maximum (60.2 days) in plant grown in CC media, which was statistically similar to Soil + CC, PM and Soil + CC media, whereas minimum days to flowering (55.1 days) were recorded in plant grown in sand substrate.

The mean data for interaction presented that maximum days taken to flowering (68 days) were recorded in T2F3 (Soil + Peat moss +30 NPK), which was statistically similar to T3F3 (Soil + Coconut coir + 30 NPK) (65.7 days) and T1F3 (Soil + 30 NPK) having 65.7 days. While minimum days to flowering (51.7 days) was recorded in T3F2 (Soil + Coconut coir + 20 NPK), which was statistically similar to T7F1 (52.7 days) and T2F2 (54.3 days).

Least days taken to blossoming were recorded in soil mix with coconut coir and NPK at 20 kg ha^{-1}. Potting media with rich nutrient content have been shown to encourage vegetative development and delayed maturity and application of such increasing substrates has been seen to minimize the time taken by plants to produce or emerge flower (Mehmood *et al.*, 2013).

NPK at higher concentration delayed flowering because nitrogen promote the vegetative growth of the plant and hence days taken to flower emergence increase.

Omaha (2004) referenced that zinnia performed best in rich when a high phosphorous, low nitrogen manure was blended in the dirt, while Ziaf *et al.*, (2004) watched a diminishing in the measure of days preceding the primary bloom development.

Seyedi *et al.* (2012), who conducted out experiment on effect of developing media on LA hybrid lilies concluded that peat as medium amendment owing to its appropriate physical and chemical properties probably makes better growth of plants to decrease days from planting to reproductive stage.

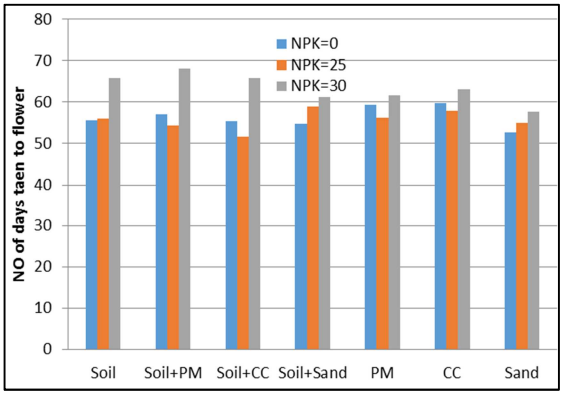

Fig. 8. Number of days taken to flower (days) of Zinnia as affected by NPK levels and different growing media.

Flower size

The interaction was also significant. Maximum flower size (6.9cm) was noted in plant which received highest level of NPK at 30 g/pot. While minimum flower size (5.1cm) was recorded in control. Maximum flower size (6.8cm) was noted in plant grown in Soil + CC media, which was statistically similar to Soil + PM media, while minimum flower size (5.25cm) were recorded in plant grown in sand substrate. The mean data for interaction showed that maximum size of flower (8.1cm) were recorded in T3F3 (Soil + CC + 30 NPK), which was statistically similar to T2F3 (Soil + PM +30 NPK) (7.9cm) followed by T2F2 (Soil + Peat moss + 20 NPK) and T1F3 (Soil + 30 NPK) having flower size of 6.83cm and 6.8cm respectively. While minimum sized flower (4.36cm) was recorded in T7F1 (Sand + 0 NPK) which was statistically similar to T4F1 (Soil + Sand + 0 NPK). These results reflect that portion of NPK used in T3F3 remained appropriate for obtaining large sized flowers. On the other hand, the lower doses of these resulted not only poor flower size but also vegetative growth. It may be postulated from these results that an appropriate amount of these as for T2F3 and T3F3 gave better flower production. The reason is that when all these were applied to plants, it resulted in enhanced photosynthesis to form early and large sized flowers. Maximum flower size was recorded when all three fertilizers Nitrogen, Phosphorous and Potash were applied in combination. The size of the blossom depends on the improvement of the plant and the stock of supplements. These outcomes are in accordance with the discoveries of Ahmed, Khan, Hamid and Hussain (2004) who inferred that where supply was better these brought about huge size blooms. While there was deficiency of supplements it brought about little measured blooms. The combination of soil + coconut coir + FYM affected the flower size because of the characteristics i.e. best water holding capacity, increased availability of nutrients potash, nitrogen and phosphorous in line with balanced pH which favor the growth of flowers. Similar study was put forward by Sardoci *et al.* (2014) in zinnia with the same results (coconut coir + soil+ FYM) which give maximum flower size. It can further concluded by the strong evidence from the research by Anuje *et al.* (2004) in gerbera where maximum flower size was attained by the media (coconut coir + soil + FYM).

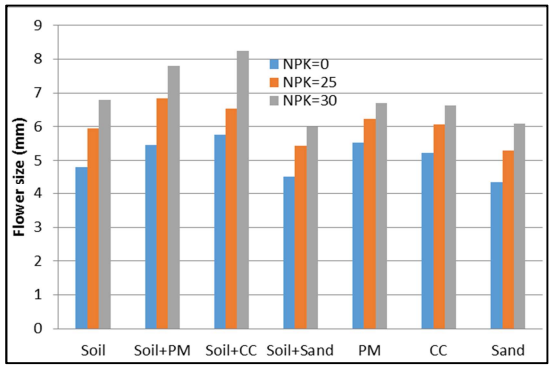

Fig. 9. Flower size (mm) of Zinnia as affected by NPK levels and different growing media.

Number of flowers

Mean information for number of blossoms are given in charts. The measurable examination of the information demonstrated that distinctive developing media and NPK levels have noteworthy impact on number of blossoms. The cooperation between NPK levels and diverse developing media was additionally critical. Number of blossom (9.33) was recorded in plant which got most elevated level of NPK at 30 g/pot. While least number of blossom (5.71) was recorded in charge. Most extreme number of blossom (9) was recorded in plant developed in Soil + CC media, which was factually like Soil + PM media, while least quantities of blooms (5.2) were recorded in plant developed in sand substrate, which were measurably like Soil + Sand media. The mean information for association shows that most extreme number of bloom (12.66) were recorded in T3F3 (Soil + CC +30 NPK), which was factually like T2F3 (Soil + PM + 30 NPK) (11.66) trailed by T5F3 (Peat greenery + 30 NPK) and T1F3 (Soil + 30 NPK) having 9.66 and 9.33 number of blossoms. Anyway least number of blossom (4) was recorded in T7F1 (Sand + 0 NPK) which was measurably like T7F2 (Sand + 20 NPK) and T4F2 (Soil + Sand + 20 NPK). These outcomes show such a source sink relationship where healthful stock from roots to the blossoming primordial stayed for bloom improvement.

These outcomes show such a source-sink relationship where nourishing inventory from the roots to the blooming primordial stayed for blossom advancement. Use of NPK seemed to have improved vegetative development, positive for the amalgamation of the digestion of peptides, proteins and starches imperative for flower advancement.

Nitrogen and potassium diminished portions delivered terrible blossoming. He additionally hypothesized that those plants which are inadequate in sustenance involve the most reduced situation so as to the quantity of blooms. It might be additionally proposed from these outcomes that a suitable measure of NPK can create better blossom generation. Singh and Gupta (1995). Comparative valuable impact of NPK on number of blooms as we watched have been accounted for by Venkatesh (1983), who recorded fundamentally higher number of blossoms in china aster with the use of NPK per ha. Jayanthi and Gowda, (1988) in chrysanthemum detailed that blooms width and blossom yield was expanded altogether with the utilization of NPK.

Riaz *et al.* (2008) found that more blooms were made by Zinnia elegans where they were developed in medium containing coconut coir in spite of the fact that coconut coir alone didn't produce these effects in this circumstance. In any case, the coconut fertilizer alone delivered fundamentally the biggest normal plant stature contrasted with the remainder of media, which wer factually at per with one another in spite of the fact that Rahbarian and Sardoei (2013) revealed comparative outcomes in the leaf excrement blend alongside the coconut manure regarding normal plant tallness.

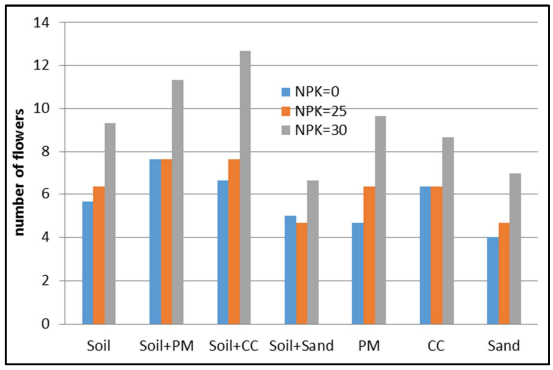

Fig. 10. Number of flowers of Zinnia as affected by NPK levels and different growing media.

Flowering Duration (Days)

A significant variation was observed in the flowering duration by application of the growing media and various level of the NPK. A significant interaction was also observed by the statistical analysis of the data of means. Highest duration for flowering (36.7 days) observed in the plants that were given highest NPK dose of 30 g/pot, and followed by a NPK dose of 20 g/pot. While lowest duration of flowering was (25.7 days) were observed in the untreated. Maximum flowering duration (34.6 days) were recorded in plant grown in Soil + PM media, which was statistically similar to Soil + CC media having flowering duration of 34.3 days, while minimum flowering duration (27.2 days) were recorded in plant grown in sand substrate,

which were statistically similar to Soil + Sand media. The mean data for interaction shows that maximum flower duration (42.3) were recorded in T2F3 (Soil + Peat moss +30 NPK), which was followed by T3F3 (Soil+ coconut coir + 30 NPK). However minimum flowering duration (22.3 days) was recorded in T7F1 (Sand + 0 NPK). Most extreme blossoming span was recorded when NPK was applied at 30kg ha-1 from an investigation in Pakistan, Abbasi *et al.* (2004) revealed that the most noteworthy paces of P and K manures altogether expanded the size and life of cut blossoms. Khan *et al.*, (2004) played out an examination in Pakistan which uncovered that the arrangement of the principal blossom in zinnia deferred while the measure of blooms/plant, size of blossoms and the length of sprouting generally diminished at a more prominent nitrogen rate, while the execution of N at 20 and 10g pot-1 was generally productive in upgrading vegetative and botanical highlights. The longer flowering duration was recorded when plant grown in soil and peat moss mix media it may be because of the fact that media of organic matter help in nutrients availability in soluble form and help the plants to increase the blooming period of flowering plant (Kumar *et al.*, 2011).

Ali *et al.* (2012) stated that hybrids of sunflowers gives flowers early when high level of nitrogen is applied which is somewhat in agreement to our results that 2 days earlier flowerings occur when high Nk level is applied. Gnyandev (2006) noticed that increased no. of flowers flower diameter and days to flowering increase with increase in fertilizer level in China aster.

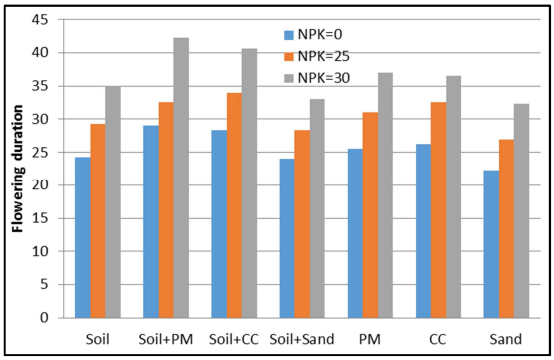

Fig. 10. Flowering duration (days) of Zinnia as affected by NPK levels and different growing media.

Conclusion

In Soil + PM media, plants peak flowering period recorded (34.6 days) was statistically comparable to Soil + CC media with a flowering duration of 34.3 days, while minimum flowering duration (27.2 days) was recorded in sand substrates plants was statistically non-significant with Soil + Sand media grown plants.

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