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# Assessment of Mepiquat Chloride in Hastening the Maturity of Groundnut

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**ABSTRACT: Groundnut (*Arachis hypogaea* L.) oilseed crop in India also known as "the poor man's nut" or "the king of vegetable oilseeds where it ranks first in terms of area and second in terms of output after soybean. Mepiquat chloride (MC) is an important growth retardant inhibits vegetative growth and accelerates the development of reproductive parts by reducing plant height, thereby decreasing the distance between the source and sink, resulting in better translocation of photosynthetic into developing pods, which is expected to improve groundnut harvest index. Hence the present study, was conducted on three groundnut genotypes viz. TG37A, J87 and SG99 to observed the difference of growth retardant mepiquat chloride, water spray. The growth retardant, mepiquat chloride @700ppm significantly reduced days to initiation of flowering, 50% flowering, completion of flowering and days to maturity for whereas SPAD value increased after growth retarded treatment in all three genotypes. Similarly, Physiological data recorded at 60 and 90 DAS revealed that plant height, root length, root weight was decreased with mepiquat chloride@700 ppm. However, number of branches, nodules number, and nodules weight, dry weight of root, leaves and shoot were more with mepiquat chloride@700 ppm over control. Source-sink relationship revealed that SG99 registered with higher Source-sink relationship at 60 DAS and J87 at 100 DAS. Pod yield, shelling percentage, and kernel yield, kernel per pod were also increased after treatment over control also added by 3.6 % increase in 100 kernel weight mepiquat@700 ppm.**

**Keywords:** Groundnut, Mepiquat chloride, SG-99, TG37A, J87, Yield trait.

## INTRODUCTION

Due to the expanding population and rising per capita income, it is expected that the demand for vegetable oil will continue to rise in the coming years. Due to the impacts of the green revolution, India is currently self-sufficient in terms of grain production. The situation for oil crops is not very encouraging. Only in India can one find the largest variety of commercial oil seed crops, such as groundnut, rapeseed, mustard, sesame, linseed, castor, sunflower, soybean, and several other minor oil seeds.

Groundnut (*Arachis hypogaea* L.) is self-pollinated, auto-tetraploid legume crop with 2n=40 chromosomes and belongs to the family Fabaceae. It is an important oilseed crop in India also known as "the poor man's nut" or "the king of vegetable oilseeds where it ranks first in terms of area and second in terms of output after soybean. It covered around 26.4 million ha worldwide with a total production of 37.1 million metric tonnes (Faldu *et al.*, 2018). According to the 1st advance estimates, the groundnut production estimate (*kharif*) was 82.54 lakh metric tonnes for 2021–22, as opposed to 85.56 million metric tonnes in 2020–21 (*kharif*). According to the Government of India, among the states, Telangana stood first in area coverage with 1.14 lakh ha, followed by Karnataka (1.01 lakh ha), Andhra Pradesh (0.23 lakh ha), Odisha (0.16 lakh ha), and Tamil Nadu (0.15 lakh ha) (Anonymous, 2021).

Plant growth regulators (PGRs) are the organic compounds, other than the nutrients, that modify physiological process in the plants. PGRs are also known as bio stimulants/bio inhibitors which act in the plant cell to stimulate/inhibit specific enzymes or enzymatic systems and helps in regulating plant metabolism. Normally, they are active in very low concentration in plants. Specific PGRs are used to modify crop growth rate, growth pattern during various stages of development, commencing from germination uphill harvest and even for post-harvest preservation. Among all plant growth regulators mepiquat chloride (MC) is a plant growth retardant which when applied foliar spray reduced plant height, leaf area, node distance, and plant canopy but increased light interception within the canopy that leads to increase yields. Application at squaring stage in groundnut reduces the partitioning of photo assimilates towards main stem, branches, and growing points but increases partitioning to the reproductive organs.

Growth promoting and inhibiting substances influence the growth in groundnut which is maintaining under genetic control however flowering, pegs, pods and seeds are influenced greatly by growth regulators. In groundnut, there is a good scope to reduce the vegetative growth and increase the reproductive phase to increase pod yield and attempts are made to achieve through growth retardants. Plant growth regulators (PGRs) are natural or synthetic organic compounds that control or modify one or more physiological events in plants. These synthetic compounds are widely used in plants, especially in cereals, in reducing plant height. The most commonly used and known PGRs group is the gibberellins. Gibberellins affect many physiological functions in plants. They are essentially responsible for controlling cell elongation and shoot and stem growth (Spitzer *et al.*, 2011). When gibberellins are applied to plants, internodes become shorter and leaves become thicker and greener, increasing both drought resistance and net photosynthesis. Mepiquat chloride (MC), which is a gibberellin acid inhibitor, inhibits cell elongation and limits overgrowth in plants. It also decreases the length of internodes and partially leaf area in plants and increases the concentration of chlorophyll in plant leaves, thus yielding increases of up to nearly 20% in plants treated with MC. The use of growth regulators such as MC to decrease plant height alters plant morphology and can alter assimilate partitioning in favour of seed growth by increasing radiation utilization efficiency. On the other hand, many PGRs substances are also widely utilized in cereals and oilseed crops to facilitate harvesting and increase yield and quality. For this reason, they are thought to have high potential in many plants. Sunflower grown under irrigated conditions is usually more productive but tends to have taller plants, causing plants to lodge.

Hence, present was formulated to observed the effect of mapiquat chloride on various growth parameters of three groundnut genotypes.

## MATERIAL AND METHODS

Field experiments were conducted at the research farm of oilseeds section, Department of Plant Breeding and Genetics, Punjab Agricultural University Ludhiana in design during spring season 2020-2021. The experimental site is located at 30°54' N latitude and 75º 48' E longitude and at an altitude of 247 meters above the mean sea level. Effect of different concentration of mapiquat chloride C@700ppm, water spray and control condition were studied on groundnut genotypes *i.e.* TG37A, J87 and SG99. Data were recorded at 60 DAS, 90 DAS and at harvest.

### *A. Phenological traits*

The data consisted of the number of days from the date of sowing the crop to the appearance of the first flower. Number of days elapsed from the date of sowing to the date of first flower opening in 50 per cent plant was recorded on the plot basis. Completion of flowering was recorded by counting the number of days required for physiological maturity i.e. when plants under go leaf senescence and all pods from the plants turn green to yellow.

### *B. Physiological Parameters*

Chlorophyll content was estimated in 4th leaf from the top (fully expended leaflet) with the help of chlorophyll meter (SPAD502 plus). Readings measured in 10 plants per plot at flowering and poding stages. Chlorophyll content is expressed in terms of Soil Plant Analysis Development (SPAD) units.

### *C. Growth parameters*

Plant height and root length were measured in centimeters from ground level to the tip of main axis from the selected five plants in each treatment from all replications at 60 and 90 DAS. The number of primary and secondary branches arising on main axis was counted from the selected five plants in each treatment from all replications at 60 and 90 DAS. At the time of harvest of observational plants, the number of nodules per plant was counted. After harvest the nodules were dried in oven thereafter the seeds were separated from nodules and dry weight of nodule walls per plant was recorded.

### *D. Dry matter partitioning*

Five plants were uprooted from each treatment and separated into root, leaf, stem and reproductive parts at 60, 80 & 100 DAS. These are first air dried and oven dried at 70°C until a constant weight is obtained. Total dry matter was calculated by adding the dry weights of different plant parts and expressed as grams per plant.

### *E. Yield traits*

Pods from the net plot area were washed and cleaned to remove the soil adhering to the pods, Impurities and immature pods. The developed pods were dried completely (up to 8 % moisture level) and weighed. On the basis of pod yield net plot$^{-1}$ the pod yield ha$^{-1}$ was calculated. A sample of 250 g of pods from the produce of whole plot in each treatment was taken and shelled to determine the shelling percentage calculated as given under:

Shelling (%) = kernel yield per plant (g)/ pod yield per plant (g) × 100

The pods from the sample plants were decorticated and the kernel weight (g) per plant obtained by dividing with the number of plants. The 100-kernels were counted and weighed in each treatment from the three replications and average. Kernel yield was calculated on the basis of kernel yield net plot$^{-1}$ the kernel yield ha$^{-1}$ was calculated as given below

Kernel yield = pod yield × shelling percent/100.

5-gram seed sample from five randomly selected plants of each variety was taken and was subjected to NMR (Nuclear Magnetic Resonance) analysis for the estimation of seed oil content.

### *F. Statistical analysis*

The data were analyzed by method of Analysis of Variance obtained by Panse and Sukhatme (1978). The recorded data in the experiment was statistically analyzed by two factorial Randomized Block Design. Significance was tested by F value at 5 per cent level of probability. Critical differences were worked out for the effects which were significant.

## RESULTS AND DISCUSSION

Our results shows that treatments of growth retardants, water spray exert their significant effect on initiation of flowering, 50%, 100% flowering and days to maturity of groundnut as compared to control (Fig. 1 a, b, c and d). Among all the varieties TG37A showed highest reduction for days to initiation (31.5 days), days to 50% flowering (35.3 days), days to maturity (103.7 days), and J87 shows completion of flowering (442.5 days). Tekale *et al* (2009) reported that bioregulators play pivotal role in improving flowering, grain filling and test weight in different crops by improving the photosynthetic activity, its assimilation and source-sink relationship. The SPAD value was highest present with mepiquat chloride@700 ppm (41.5). Among the genotypes maximum SPAD mean value was registered in TG37A (42.3) followed by J87 (40.7) whereas minimum was recorded in SG99 (39.9) (Fig e).

*A. Growth parameters at 60 DAS*

Mepiquat chloride@700 ppm treatment significantly reduced the plant height and higher reduction was observed in TG37A (13.7 cm). The mean value indicated that TG37A showed higher reduction in plant height (15.2 cm) as compared to other varieties of groundnuts (Table 1). Pettigrew and Johnson (2005) found that the application of plant growth regulator mepiquat chloride in cotton reduced the plant height. They also found the reduced number of stem nodes and 4 % reduction in height to node ratio. Mean value of primary and secondary branches revealed that highest branches were observed and comparison between genotypes revealed that TG37A had more number of primary branches (7.43) and secondary branches (3.06) (Table 1). Vinothini *et al* (2018) observed that the spraying of chlorocholine chloride at flowering stage has been found to increase the number of branches per plant in groundnut. The maximum root length registered with mepiquat chloride@700 ppm (9.18 cm) over control. Among the genotypes maximum root length registered in SG99 (9.30 cm) and minimum was observed in J87 (8.72 cm) (Table 1).

Number of leaves, nodules and gynophores were significantly higher with mepiquat chloride@700ppm i.e. 43.33, 37.43 and 13.78 respectively compared to control and water spray (Table 1). Among genotypes, more number of leaves and nodules observed in TG37A (57.5 and 31.11 respectively) whereas gynophores higher in SG99 (12.33). Similarly, application of cycocel @ 150 ppm improved the number of nodules and number of lateral branches per plant in green gram (Kshirsagar *et al.,* 2008).

The maximum weight of leaves, nodules, shoot observed with mepiquat chloride@700 ppm i. e. 27.67 g, 0.15 g and 13.46 g respectively whereas higher root weight observed with control i.e. 13.4 g (Table 2). Muthukumar *et al.,* (2005) reported that application of mepiquat chloride @ 200 ppm produced the highest values of yield parameters *viz.,* length, diameter, and weight of cob and corn. It was found that mepiquat chloride also affects the chlorophyll content, area of leaf, sugar and starch content and stem dry weight (Rigon *et al* 2011). More number and weight of mature pods observed with mepiquat chloride@700 ppm i.e. 10.54 and 0.342 g respectively while more number of immature pods recorded with control that 13.17 and weight with water spray i.e. 0.348 g respectively. Comparison between varieties revealed that TG37A showed the more number and weight of mature pods. Sandhu *et al.,* (2015) reported significant effect of mepiquat chloride on dry matter per plant, pod dry weight, number of pods per plant and seed yield of summer mung bean.

*B. Growth parameters at 90 DAS*

At 90 DAS, plant height significantly reduced (37.1 cm) with mepiquat chloride@700 ppm as compared to water spray (40.0 cm) and control (45.2 cm). Among the genotypes, higher plant height recorded in SG99 (45.2) followed by J87 (40.3) and TG37A (36.9) (Table 4.1.37**)** (Table 3). Our results are close agreement with Campos *et al* (2010), who reported that plant treatment with lower concentration of ethephon resulted in reduced plant height. The more number of primary branches observed with control (7.60) while higher secondary branches (5.77) observed with mepiquat chloride@700 ppm. Comparison between varieties revealed that J87 had higher number of primary branches (7.89 branches) and secondary branches (6.06). Application of mepiquat chloride 500 mg $l^{-1}$ in soybean gave the higher number of branches per plant (Kaur *et al.,* 2015).

Deshmukh *et al.,* (2009) also reported variation in number of branches/plants among different genotypes of pigeonpea. On the other hand, mepiquat chloride@700 ppm reduces the root length (14.0 cm) over control (14.7 cm). Among the genotypes J87 and SG99 had higher root length (14.4 cm). Number of leaves (129.2), nodules (45.82) and gynophores (17.93) significantly higher with mepiquat chloride@700 ppm over control (Table 3). Comparisons between genotypes revealed that J87 had more number of leaves (125.3) whereas TG37A had more number of nodules (43.67) and gynophores (17.74).

Mepiquat chloride help in attaining an adequate balance between shoot and root growth, therefore increasing the transport of metabolites to organs that favour greater yield (De almeida and Rosolem 2012). Similarly, weight of leaves (27.67g), nodules (0.226 g) and shoot (16.74 g) higher with mepiquat chloride@700 ppm over control (Table 4). Comparisons between genotypes revealed that TG37A had higher weight of leaves (26.00), nodule (0.219 g) whereas shoot weight higher in J87 (16.26 g).

Similarly, (Mao *et al* 2014) reported that mepiquat chloride increases the partitioning to leaves expressed as leaf shoot ratio. Studies made by root weight (1.31g) was significantly reduces with mepiquat chloride@700 ppm than the control. Among the genotypes SG99 had higher root weight (1.37g). Similarly, studied made by Singh and Misra (2001) on effect of $GA_3$ and ethrel at high concentration (1000 µg/ml) on *Mentha spicata* var. M35-5 showed enhancement in fresh weight biomass, leaf stem ratio, specific leaf weight and chlorophyll content.

The more number and weight of mature pods observed with mepiquat chloride@700 ppm i.e. 33.43 and 0.653 g respectively while more number of immature pods recorded with control that 26.81 and 0.0500 g respectively. Comparison between varieties revealed that TG37A (31.07 and 0.589 g) registered with more number and weight of mature pods. Kaur *et al.*, (2015) reported in soybean that application of mepiquat chloride @ 500 mg $l^{-1}$ increased the number of pods per plant than water spray.

*C. Source-sink relationship*

At 60 DAS source-sink value varied from 0.0310 (mepiquat chloride @700 ppm) to 0.0430 (control) and 0.0180 (mepiquat chloride @700 ppm) to 0.0250 (control) at 100 DAS (Table 5). Genotypic means revealed that SG99 had highest source-sink value i.e. 0.0470 and 0.0270 at 60 and 100 DAS respectively.

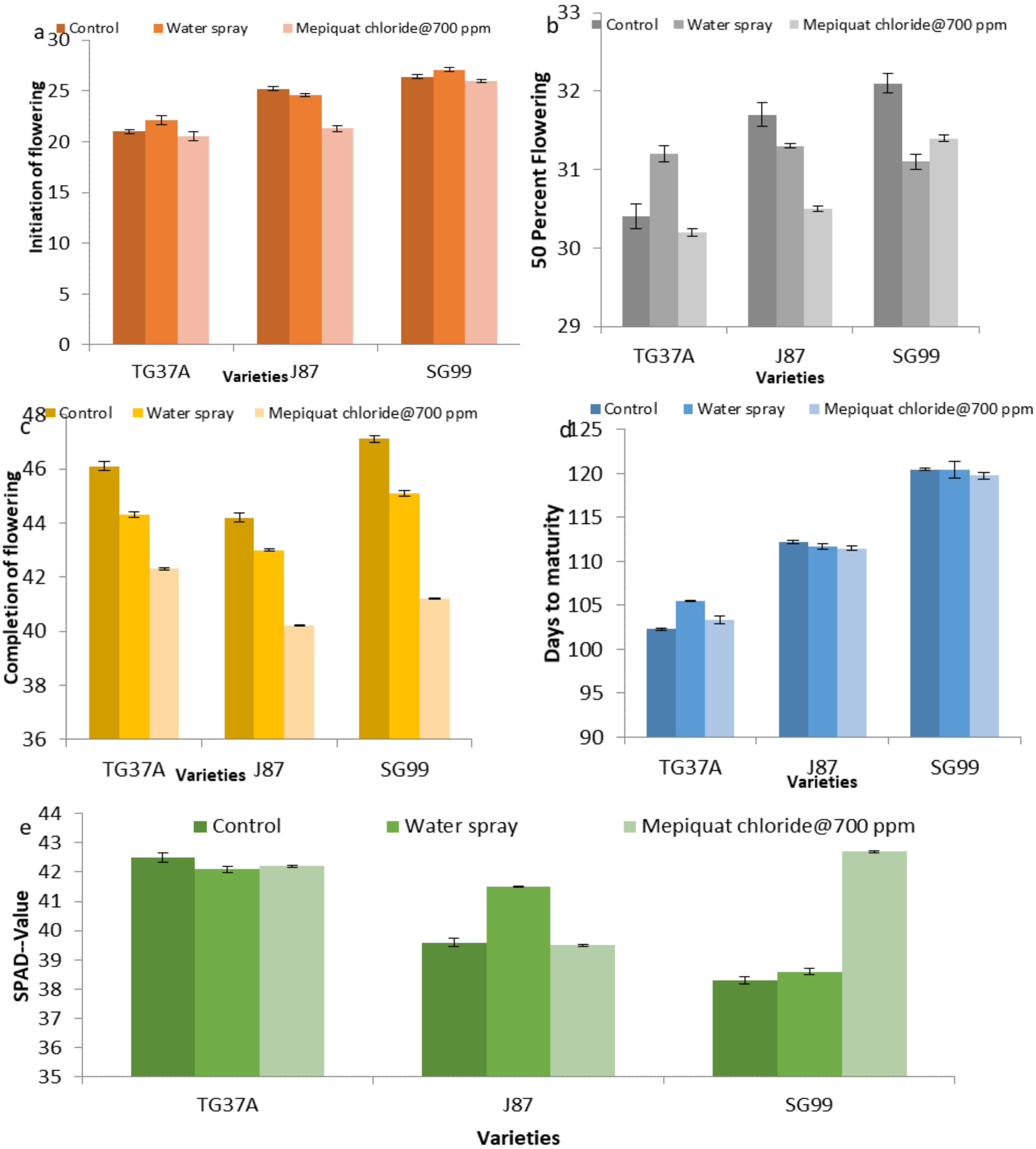



**Fig. 1.** Effect of foliar spray on flowering behavior, days to maturity and SPAD-Values in three groundnut genotypes a) initiation of flowering b) 50% flowering c) completion of flowering d) days to maturity e) SPAD Values.

Plant hormones are also known to enhance the source-sink relationship and stimulate the translocation of photo-assimilates, seed germination, leaf expansion, flower and fruit set, dry matter production, photosynthesis, translocation of food material and synthesis of mRNA coding for hydrolytic enzymes thereby increasing the productivity (Mazid *et al.*, 2010).

**At harvest.** At harvest stage, more number and weight of mature pods observed with mepiquat chloride@700 ppm i.e. 3339 and 3.182 g respectively while more number of immature pods recorded with control i.e. 591 and weight was found with water spray i.e. 0.378 g respectively (Table 6).

Comparison between varieties revealed that TG37A had more number and weight (3174 and 2.896 g respectively) of mature pods. Similarly, mepiquat chloride@700 ppm resulted more pods yield (4120 kg ha$^{-1}$) followed by water spray (3532 kg ha$^{-1}$) and control (3444 kg ha$^{-1}$). Among the genotypes J87 had more pod yield (4115 kg ha$^{-1}$) followed by TG37A (3708 kg ha$^{-1}$) and SG99 (3272 kg ha$^{-1}$) (Table 6). Similarly, Shah and Prathapasenan (2008) found that Cycocel at 1000 ppm increased the number of pods per plant, number of seed per pod, increased seed yield per plant in mungbean. The shelling % (70.3%) and oil content (50.6 %) higher in mepiquat chloride@700 ppm over control (Table 6) Similarly, comparison between genotypes revealed that shelling % higher in SG99 i.e. 69.8 % while maximum oil content higher in TG37 i.e. 51.9 % (Table 6). Earlier, Naz (2006) documented that foliar spray of salicylic acid @ 500 ppm increased shelling%, harvest index, test weight and oil% of kernels in groundnut cv. JL-24 Kernels/pod varied from 2.11 to 2.59.

**Table 1: Effect of foliar spray at 50 DAS on crop growth data recorded at 60 days.**

| | Plant height (cm) | | | | Primary branches | | | | Secondary branches | | | | Root length (cm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Treatment/Varieties | **TG37A** | **J87** | **SG99** | **Mean** | **TG37A** | **J87** | **SG99** | **Mean** | **TG37A** | **J87** | **SG99** | **Mean** | **TG37A** | **J87** | **SG99** | **Mean** |
| Control | 15.3 | 15.5 | 22.1 | 17.6 | 7.50 | 7.20 | 5.70 | 7.50 | 3.22 | 2.31 | 2.12 | 2.55 | 9.01 | 9.71 | 8.21 | 8.98 |
| Water spray | 16.6 | 17.8 | 16.2 | 16.9 | 8.47 | 6.80 | 6.30 | 8.47 | 2.74 | 2.91 | 2.72 | 2.79 | 9.31 | 8.11 | 9.71 | 9.04 |
| Mepiquat chloride@700 ppm | 13.7 | 15.8 | 16.7 | 15.4 | 9.70 | 8.30 | 7.70 | 9.70 | 3.22 | 3.21 | 3.24 | 3.22 | 9.21 | 8.34 | 9.99 | 9.18 |
| Average | 15.2 | 16.4 | 18.3 | | 8.56 | 7.43 | 6.57 | 8.56 | 3.06 | 2.81 | 2.69 | | 9.18 | 8.72 | 9.30 | |
| CD (p=0.05) | T=0.388, V=0.395, TxV=0.672 | | | | T=0.145, V=0.146, TxV=0.250 | | | | T=0.088, V=NS, TxV=NS | | | | T=NS, V=0.294, TxV=0.509 | | | |

| | Number | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Leaves** | | | | **Nodules** | | | | **Gynophores** | | | |
| Treatment/Varieties | **TG37A** | **J87** | **SG99** | **Mean** | **TG37A** | **J87** | **SG99** | **Mean** | **TG37A** | **J87** | **SG99** | **Mean** |
| Control | 52.3 | 45.2 | 54.0 | 50.4 | 20.33 | 21.83 | 29.17 | 23.78 | 8.84 | 11.16 | 13.67 | 11.22 |
| Water spray | 44.9 | 52.0 | 53.5 | 50.1 | 29.66 | 35.60 | 24.50 | 29.92 | 8.67 | 9.67 | 12.83 | 10.39 |
| Mepiquat chloride@700 ppm | 77.5 | 71.8 | 64.8 | 71.4 | 43.33 | 33.83 | 35.13 | 37.43 | 16.83 | 14.00 | 10.50 | 13.78 |
| Average | 57.5 | 57.4 | 57.4 | | 31.11 | 30.42 | 29.60 | | 11.45 | 11.61 | 12.33 | |
| CD (p=0.05) | T=1.498, V=NS, TxV=2.594 | | | | T=0.838, V=0.856, TxV=1.451 | | | | T=0.242, V=0.271, TxV=0.419 | | | |

**Table 2: Effect of foliar spray at 50 DAS on dry matter/plant (g) recorded at 60 days.**

| | Weight (g) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Treatment/Varieties** | **Leaves** | | | | **Nodules** | | | | **Shoot** | | | | **Root** | | | |
| | **TG37A** | **J87** | **SG99** | **Mean** | **TG37A** | **J87** | **SG99** | **Mean** | **TG37A** | **J87** | **SG99** | **Mean** | **TG37A** | **J87** | **SG99** | **Mean** |
| Control | 18.20 | 22.02 | 18.74 | 19.65 | 0.123 | 0.153 | 0.113 | 0.130 | 12.23 | 16.62 | 11.52 | 13.46 | 1.28 | 1.40 | 1.33 | 1.34 |
| Water spray | 27.02 | 15.43 | 17.39 | 19.95 | 0.145 | 0.123 | 0.120 | 0.130 | 14.78 | 15.10 | 14.53 | 14.81 | 1.31 | 1.22 | 1.48 | 1.33 |
| Mepiquat chloride@700 ppm | 32.79 | 32.67 | 17.55 | 27.67 | 0.223 | 0.122 | 0.105 | 0.150 | 18.99 | 17.05 | 14.19 | 16.74 | 1.38 | 1.24 | 1.30 | 1.31 |
| Average | 26.00 | 23.37 | 17.89 | | 0.164 | 0.133 | 0.113 | | 15.34 | 16.26 | 13.41 | | 1.32 | 1.29 | 1.37 | |
| CD (p=0.05) | T=0.73, V=0.72, TxV=1.248 | | | | T=0.003, V=0.006, TxV=0.008 | | | | T=0.198, V=0.199, TxV=0.343 | | | | T=NS, V=0.037, TxV=0.064 | | | |

| | Number | | | | | | | | Weight (g) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Treatment/Varieties | **Mature pods** | | | | **Immature pods** | | | | **Mature pods** | | | | **Immature pods** | | | |
| | **TG37A** | **J87** | **SG99** | **Mean** | **TG37A** | **J87** | **SG99** | **Mean** | **TG37A** | **J87** | **SG99** | **Mean** | **TG37A** | **J87** | **SG99** | **Mean** |
| Control | 6.89 | 7.50 | 8.20 | 7.53 | 14.67 | 10.5 | 14.34 | 13.17 | 0.221 | 0.262 | 0.201 | 0.228 | 0.331 | 0.343 | 0.327 | 0.334 |
| Water spray | 7.89 | 7.89 | 7.89 | 7.89 | 14.17 | 9.33 | 6.67 | 10.06 | 0.242 | 0.253 | 0.235 | 0.243 | 0.352 | 0.343 | 0.348 | 0.348 |
| Mepiquat chloride@700 ppm | 11.83 | 10.33 | 9.47 | 10.54 | 6.84 | 9.5 | 13.0 | 9.78 | 0.374 | 0.296 | 0.357 | 0.342 | 0.277 | 0.239 | 0.257 | 0.258 |
| Average | 8.87 | 8.57 | 8.52 | | 11.89 | 9.78 | 11.34 | | 0.279 | 0.270 | 0.264 | | 0.320 | 0.308 | 0.311 | |
| CD (p=0.05) | T=0.176, V=0.174, TxV=0.302 | | | | T=0.242, V=0.271, TxV=0.419 | | | | T=0.0014, V=0.018, TxV=0.025 | | | | T=0.0015, V=0.013, TxV=0.023 | | | |

**Table 3: Effect of foliar sprays at 60 DAS on crop growth data recorded at 100 days.**

| | Plant height (cm) | | | | Primary branches | | | | Secondary branches | | | | Root length (cm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Treatment/Varieties | TG37A | J87 | SG99 | Mean | TG37A | J87 | SG99 | Mean | TG37 A | J87 | SG99 | Mean | TG37 A | J87 | SG99 | Mean |
| Control | 41.6 | 43.8 | 50.2 | 45.2 | 7.60 | 6.93 | 7.20 | 7.60 | 5.13 | 5.74 | 4.60 | 5.16 | 14.7 | 14.3 | 15.2 | 14.7 |
| Water spray | 34.7 | 40.8 | 44.7 | 40.0 | 7.33 | 8.40 | 7.53 | 7.33 | 5.87 | 5.87 | 5.47 | 5.73 | 14.1 | 14.6 | 13.7 | 14.2 |
| Mepiquat chloride@700 ppm | 34.5 | 36.3 | 40.6 | 37.1 | 7.20 | 8.33 | 7.87 | 7.20 | 5.27 | 6.57 | 5.47 | 5.77 | 13.4 | 14.2 | 14.4 | 14.0 |
| Average | 36.9 | 40.3 | 45.2 | | 7.38 | 7.89 | 7.53 | | 5.42 | 6.06 | 5.18 | | 14.1 | 14.4 | 14.4 | |
| CD (p=0.05) | T=1.040, V=1.037, TxV=1.796 | | | | T=0.126, V=0.119, TxV=0.205 | | | | T=0.128, V=0.137, TxV=0.222 | | | | T=0.NS, V=0.361, TxV=0.625 | | | |

| | Number | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Leaves | | | | Nodules | | | | Gynophores | | | |
| Treatment/Varieties | TG37A | J87 | SG99 | Mean | TG37A | J87 | SG99 | Mean | TG37A | J87 | SG99 | Mean |
| Control | 116.6 | 114.0 | 104.4 | 111.7 | 35.67 | 32.87 | 26.40 | 31.65 | 17.13 | 16.80 | 14.53 | 16.15 |
| Water spray | 114.2 | 114.2 | 114.2 | 114.2 | 41.98 | 31.53 | 31.40 | 34.96 | 16.87 | 17.20 | 16.97 | 17.01 |
| Mepiquat chloride@700 ppm | 134.1 | 132.1 | 121.5 | 129.2 | 53.39 | 31.80 | 52.27 | 45.82 | 19.20 | 17.33 | 17.27 | 17.93 |
| Average | 117.6 | 125.3 | 112.2 | | 43.67 | 32.07 | 36.69 | | 17.74 | 17.11 | 16.26 | |
| CD (p=0.05) | T=3.463 V=4.463, TxV=5.997 | | | | T=0.991, V=0.949, TxV=1.643 | | | | T=0.414, V=0.465, TxV=0.805 | | | |

**Table 4: Effect of foliar sprays at 60 DAS on dry matter/ plant (g) recorded at 100 days.**

| | Weight (g) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Treatment/Varieties | Leaves | | | | Nodules | | | | Shoot | | | | Root | | | |
| | TG37 A | J87 | SG99 | Mean | TG37 A | J87 | SG99 | Mean | TG37 A | J87 | SG99 | Mean | TG37 A | J87 | SG9 9 | Mea n |
| Control | 27.02 | 15.43 | 17.39 | 19.95 | 0.183 | 0.170 | 0.143 | 0.166 | 12.23 | 16.62 | 11.52 | 13.46 | 1.28 | 1.40 | 1.33 | 1.34 |
| Water spray | 19.65 | 19.65 | 19.65 | 19.65 | 0.223 | 0.163 | 0.140 | 0.176 | 14.78 | 15.10 | 14.53 | 14.81 | 1.31 | 1.22 | 1.48 | 1.33 |
| Mepiquat chloride@700 ppm | 32.79 | 32.67 | 17.55 | 27.67 | 0.250 | 0.240 | 0.187 | 0.226 | 18.99 | 17.05 | 14.19 | 16.74 | 1.38 | 1.24 | 1.30 | 1.31 |
| Average | 26.00 | 23.37 | 17.89 | | 0.219 | 0.191 | 0.157 | | 15.34 | 16.26 | 13.41 | | 1.32 | 1.29 | 1.37 | |
| CD (p=0.05) | T=0.730, V=0.763, TxV=1.997 | | | | T=0.009, V=0.006, TxV=0.01 | | | | T=0.198, V=0.199, TxV=0.343 | | | | T=NS, V=0.037, TxV=0.065 | | | |

| | Number | | | | | | | | Weight (g) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Treatment/Varieties | Mature pods | | | | Immature pods | | | | Mature pods | | | | Immature pods | | | |
| | TG37 A | J87 | SG99 | Mean | TG37 A | J87 | SG99 | Mean | TG37 A | J87 | SG99 | Mean | TG37 A | J87 | SG9 9 | Mea n |
| Control | 26.21 | 24.47 | 26.74 | 25.81 | 21.30 | 24.33 | 34.80 | 26.81 | 0.517 | 0.563 | 0.503 | 0.528 | 0.530 | 0.44 3 | 0.52 7 | 0.50 0 |
| Water spray | 28.7 | 25.4 | 25.09 | 26.40 | 11.87 | 21.76 | 25.40 | 19.68 | 0.540 | 0.593 | 0.533 | 0.555 | 0.450 | 0.44 3 | 0.49 0 | 0.46 1 |
| Mepiquat chloride@700 ppm | 38.3 | 31.7 | 30.3 | 33.43 | 13.67 | 23.53 | 20.40 | 19.20 | 0.710 | 0.593 | 0.657 | 0.653 | 0.377 | 0.39 0 | 0.35 7 | 0.37 5 |
| Average | 31.07 | 27.19 | 27.38 | | 15.61 | 23.21 | 26.87 | | 0.589 | 0.583 | 0.564 | | 0.452 | 0.42 5 | 0.45 8 | |
| CD (p=0.05) | T=0.742, V=0.771, TxV=1.286 | | | | T=0.568, V=0.595, TxV=1.003 | | | | T=0.568, V=0.595, TxV=1.003 | | | | T=0.015, V=0.013, TxV=0.023 | | | |

**Table 5: Source-sink relationship in three varieties of groundnut.**

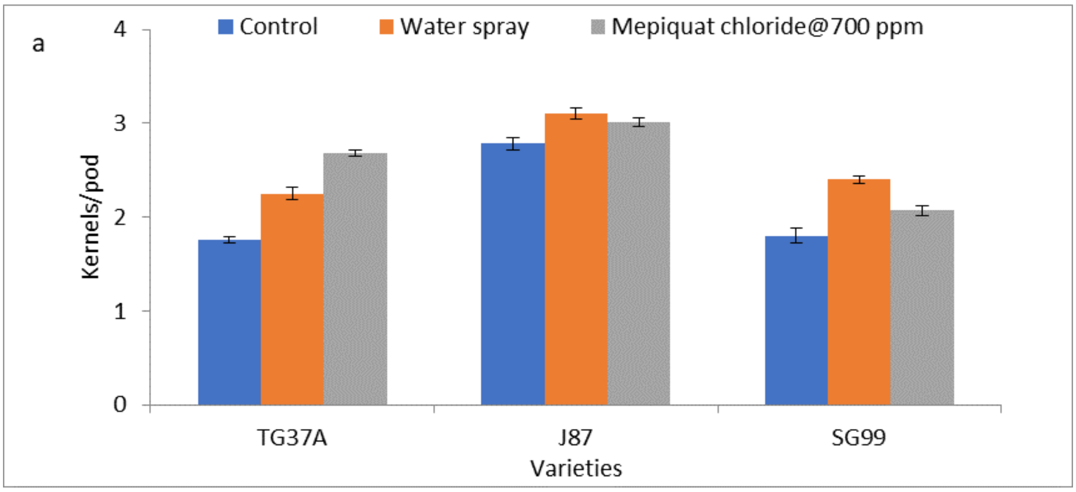
| Treatment/Varieties | 60 DAS | | | | 100 DAS | | | |
|---|---|---|---|---|---|---|---|---|
| | TG37A | J87 | SG99 | Mean | TG37A | J87 | SG99 | Mean |
| Control | 0.0330 | 0.0450 | 0.0500 | 0.0430 | 0.0260 | 0.0200 | 0.0300 | 0.0250 |
| Water spray | 0.0360 | 0.0260 | 0.0610 | 0.0410 | 0.0150 | 0.0190 | 0.0330 | 0.0230 |
| Mepiquat chloride@700 ppm | 0.0360 | 0.0300 | 0.0290 | 0.0310 | 0.0170 | 0.0190 | 0.0170 | 0.0180 |
| Average | 0.0350 | 0.0340 | 0.0470 | | 0.0190 | 0.0190 | 0.0270 | |
| CD (p=0.05) | T=0.001, V=0.003, TxV=0.005 | | | | T=0.002, V=0.005, TxV=0.008 | | | |

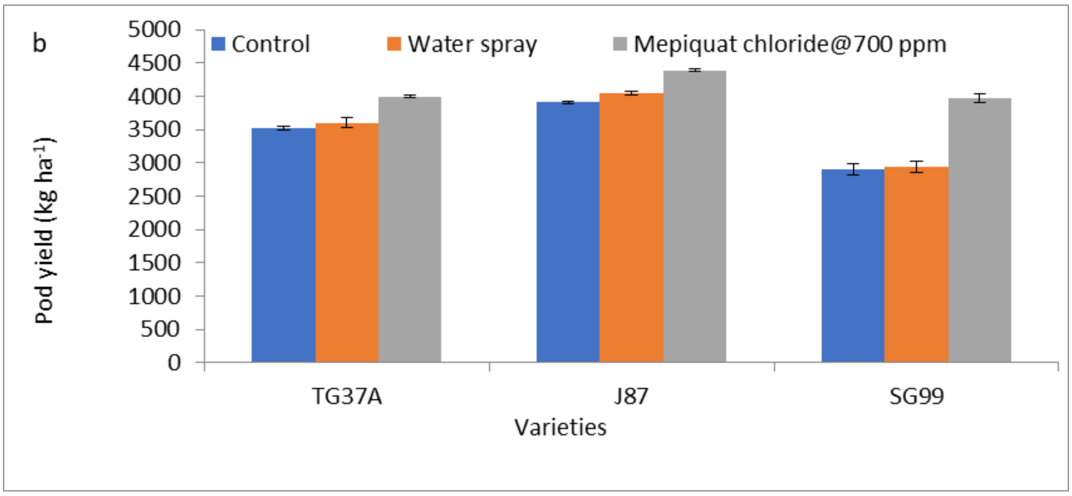
The highest kernels/pod registered with mepiquat chloride@700 ppm (2.59) which is at par with water spray (2.58) whereas minimum observed with control (2.11) (Fig. 2a). Comparison between genotypes revealed that higher kernels/pod. Sharma and Lashkari (2009) obtained maximum number of tender pods per plant, length and width of pods, volume of pods and total crude protein content with the application of CCC 1000 ppm whereas highest seed yield was recorded by CCC 2000 ppm registered in J87 (2.96) followed by TG37A (2.23) and minimum recorded in SG99 (2.09). Similar trend observed with kernal yield as kernel/pod (Fig. 2b). Maximum kernel yield recorded with mepiquat chloride@700 ppm (2895 kg ha$^{-1}$) and minimum registered with control (2329 g ha$^{-1}$). Among the genotypes, more kernel yield observed in J87 (2837 g ha$^{-1}$) followed by TG37A (2528 g ha$^{-1}$) and minimum recorded with (2284 g ha$^{-1}$) in SG99 (Fig. 2c).

Similarly, Meena *et al.*, (2022) revealed that the application of plant growth regulators significantly increased number of pods per plant and finally kernel yield per plant which is the most important yield determining components in groundnut.

**Table 6: Yield parameters recorded at harvest on per plot basis.**

| Treatment/Varieties | Number of mature pods/plot | | | | Weight of mature pods/plot(g) | | | | Number of immature pods/plot | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **TG37A** | **J87** | **SG99** | **Mean** | **TG37A** | **J87** | **SG99** | **Mean** | **TG37A** | **J87** | **SG99** | **Mean** |
| Control | 2780 | 2543 | 2504 | 2609 | 2.756 | 2.211 | 2.421 | 2.463 | 530 | 716 | 528 | 591 |
| Water spray | 3313 | 3047 | 2932 | 3097 | 2.389 | 2.843 | 2.531 | 2.588 | 503 | 613 | 456 | 524 |
| Mepiquat chloride@700 ppm | 3428 | 3313 | 3274 | 3339 | 3.543 | 3.231 | 2.773 | 3.182 | 326. | 379 | 523 | 409 |
| Average | 3174 | 2968 | 2903 | | 2.896 | 2.762 | 2.575 | | 453 | 569 | 502 | |
| CD (p=0.05) | T=65.56, V=61.56, TxV=NS | | | | T=0.083, V=0.086, TxV=0.145 | | | | T=12.77, V=10.21, TxV=22.13 | | | |
| | | | | | | | | | | | | |
| | **Weight of immature pods/plot (g)** | | | | **Oil content (%)** | | | | **Shelling %** | | | |
| Control | 0.392 | 0.316 | 0.376 | 0.362 | 51.6 | 49.2 | 50.4 | 50.4 | 66.5 | 67.5 | 69.2 | 67.7 |
| Water spray | 0.259 | 0.359 | 0.517 | 0.378 | 51.9 | 49.0 | 50.6 | 50.5 | 67.9 | 68.5 | 69.8 | 68.7 |
| Mepiquat chloride@700 ppm | 0.243 | 0.329 | 0.316 | 0.296 | 52.3 | 49.9 | 49.7 | 50.6 | 69.9 | 70.6 | 70.3 | 70.3 |
| Average | 0.298 | 0.335 | 0.403 | | 51.9 | 49.4 | 50.2 | | 68.1 | 68.9 | 69.8 | |
| CD (p=0.05) | T=0.016, V=0.011, TxV=0.018 | | | | V=NS, T=1.715, TxV=NS | | | | V=1.649, T=1.682, TxV=2.855 | | | |



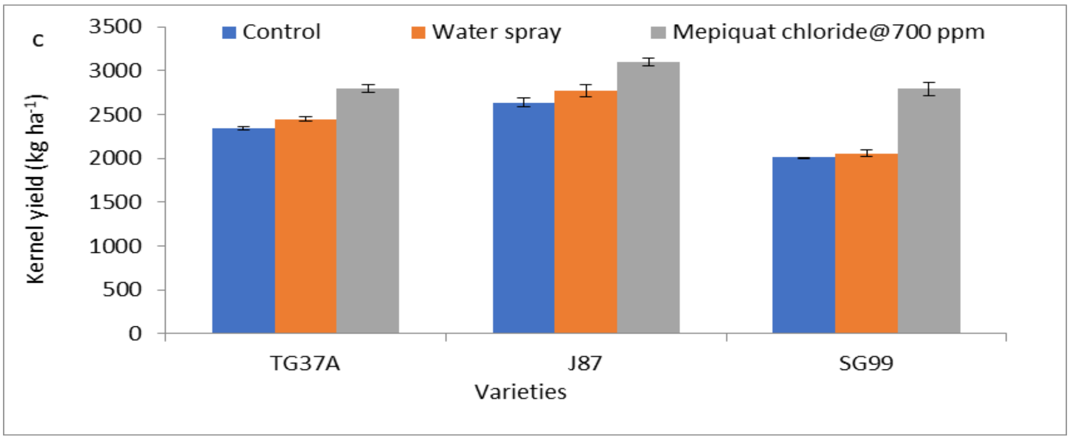



**Fig. 2.** Effect of foliar sprays of mepiquat chloride on a) kernel/pod b) pod yield and c) kernel yield.

## CONCLUSION

Mepiquat chloride (MC) is an important growth retardant inhibits vegetative growth and accelerates the development of reproductive parts by reducing plant height, thereby decreasing the distance between the source and sink, resulting in better translocation of photosynthetic into developing pods, which is expected to improve groundnut harvest index. Hence the present study, was conducted on three groundnut genotypes viz. TG37A, J87 and SG99 to observed the difference of growth retardant mepiquat chloride, water spray. The growth retardant, mepiquat chloride @700ppm significantly reduced days to initiation of flowering, 50% flowering, completion of flowering and days to maturity for whereas SPAD value increased after growth retarded treatment in all three genotypes.

## FUTURE SCOPE

Groundnut is the most important oilseed-cum-food legume crop in the world.Being a leguminous plant it plays an important role in crop rotation and in enriching the soil. The groundnut sheller can be modified with sufficient market penetration, would offer a substantial in shelling efficiency.

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