J. Soils and Crops 27 (1) 143-146, June 2017 ISSN 0971-2836

GROWTH AND FLOWERING OF ANNUAL CHRYSANTHEMUM INFLUENCED BY CYCOCEL AND PACLOBUTRAZOL

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ABSTRACT

An experiment entitled "Growth and flowering of annual chrysanthemum as influenced by cycocel and paclobutrazol" was carried out at the farm of Horticulture Section, College of Agriculture, Nagpur during *rabi* season of the year 2015-2016. The experiment was laid out in Randomised Block Design with nine treatments. The treatments comprised viz., T_1– Control, T_2- Cycocel 1000 ppm, T_3-Cycocel 1500 ppm, T_4- Cycocel 2000 ppm, T_5- Cycocel 2500 ppm, T_6- Paclobutrazol 20 ppm, T_7- Paclobutrazol 30 ppm, T_8- Paclobutrazol 40 ppm and T_9- Paclobutrazol 50 ppm. The results revealed that, significantly minimum plant height (92.56 cm) was recorded in treatment paclobutrazol at 50 ppm. Maximum branches plant^{-1} (34.26) and plant spread (46.76 cm) were recorded in treatment of cycocel at 2500 ppm. However, maximum stem diameter (2.67 cm) was recorded in cycocel at 2500 ppm. Maximum leaf area (51.07 cm^2) was obtained in treatment control. In respect of flowering parameters, significantly maximum flowers plant^{-1} (106.0) were recorded in individual treatment of cycocel at 2500 ppm. However, first flower bud initiation (38.13 days) and days to fully opened flower from bud emergence (16.23 days), days to 50% flowering (64.23 days), days to first harvesting from transplanting (66.25 days) were recorded in control treatment.

(Key words:Annual chrysanthemum, cycocel, paclobutrazol, growth, flowering)

INTRODUCTION

Annual chrysanthemum native of Mediterranean and Europe belongs to family Asteraceae. Commonly it is also known as 'Garland chrysanthemum' or 'Crown daisy'. It is fast growing winter blooming annual. It is one of the cheapest source of floral material for worship and garland particularly in early summer months when flowers are inadequate in supply. Apart from these, it is used in potted plant, vases, festivals, border in garden, bouquets making, marriage ceremony and floral decoration. Its leaves steamed or boiled used as greens, especially chinise cuisine, yellow and white chrysanthemum flowers are boiled to make a sweet drink in some part of Asia known as 'Chrysanthemum tea' has many medicanal uses, bioactive terpens such as dihydro chrysanoride and cumabrine, contents of essential oil proven to have medical effect on cancer and blood pressure reduction. Naturally upright growth habit of annual chrysanthemum create problem such as less number of branches, minimum plant spread and less number of flower and resulting marginal profit to the farmer. Maximum upright plant growth energy diverted into vegetative growth then it affected reproductive growth.

In annual flower crops, flower yield is mainly dependent on number of flower bearing branches which can be manipulated by arresting the vertical growth of plants and encouraging side shoots . Such side shoots would provide more scope to bear flower and contributing for higher flower yield. The plant growth retardants such as cycocel and paclobutrazol are used to overcoming the factors limiting the growth and yield to harness maximum benefit from flower production. Considering the above facts present investigation was under taken to study the effect of cycocel and paclobutrazol on growth and flowering of annual chrysanthemum.

MATERIALS AND METHODS

The present investigation was carried out at the farm of Horticulture Section, College of Agriculture, Nagpur during *rabi* season of the year 2015-2016 with nine treatments in Randomised Block Design. The treatments comprised viz., T_1– Control, T_2- Cycocel 1000 ppm, T_3- Cycocel 1500 ppm, T_4- Cycocel 2000 ppm, T_5- Cycocel 2500 ppm, T_6- Paclobutrazol 20 ppm T_7- Paclobutrazol 30 ppm T_8- Paclobutrazol 40 ppm and T_9- Paclobutrazol 50 ppm.

The annual chrysanthemum seeds were sown at 25 days before the actual transplanting date on previously sterilized raised bed and seedlings were prepared. Seeds were sown on nursery bed of 3 m x 1 m x 0.15 m size. Necessary care was taken to raise healthy and strong seedlings for transplanting. Seedlings were transplanted on raised bed with planting of one seedling hill^{-1} in the experimented field on 15th October, 2015 at the distance of 60 cm x 45 cm.

Recommended dose of farm yard manure and chemical fertilizers for annual chrysanthemum was 5 tones ha^{-1} FYM and 100:50:50 NPK kg ha^{-1}. The half dose of

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nitrogen and full dose of phosphorus and potassium were applied at the time of transplanting. The remaining half dose of nitrogen (N) was applied one month after transplanting.

After 15 days transplanting common pinching was done. The solutions of cycocel (1000, 1500, 2000, 2500 ppm) and paclobutrazol (20, 30, 40, 50 ppm) were prepared by taking the required quantity of chemical diluted in alcohol and volume was made in water as per treatment concentrations. The cycocel and paclobutrazol solutions of the respective concentration were sprayed once at 25 DAT.

Observations on plant height (cm), stem diameter (cm) and branches plant^{-1} were recorded at 90 DAT. Observations on plant spread (cm) and leaf area (cm^2) were recorded at 50% flowering stage. Flowering parameters *viz*., days to first flower bud initiation , days to fully opened flower from bud emergence, days to 50% flowering, flowers plant^{-1}, days to harvest seed from bud emergence were also recorded and analyzed statistically as per the method suggested by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

Growth parameters

All the parameters were influenced significantly due various growth retardants (Table 1). Significantly minimum plant height (92.56 cm) recorded in treatment paclobutrazol 50 ppm, whereas paclobutrazol 40 ppm (95.35 cm), cycocel 2500 ppm (95.60 cm), paclobutrazol 30 ppm (96.36 cm), cycocel 2000 ppm (100.40 cm) and paclobutrazol 20 ppm (101.08 cm) were found next in order. This might due to the fact that, an application of of paclobutrazol at different concentrations might have reduced plant height by decreasing the internodal length as a result of decrease in cell elongation. However, maximum stem diameter (2.67 cm) recorded with the application of cycocel 2500 ppm. Next to this treatment, treatments were paclobutrazol 50 ppm (2.66 cm), paclobutrazol 40 ppm (2.61 cm), paclobutrazol 30 ppm (2.58 cm), cycocel 2000 ppm (2.55 cm), paclobutrazol 20 ppm (2.51 cm) and cycocel 1500 ppm (2.48 cm). Significantly, maximum number of branches plant^{-1} (34.26) was recorded in treatment cycocel 2500 ppm followed by treatment paclobutrazol 40 ppm (33.36). Maximum plant spread (46.76 cm) was recorded with the application of cycocel at 2500 ppm. Next to this treatment, treatments were paclobutrazol 40 ppm (44.66 cm), cycocel 2000 ppm (42.86 cm) and paclobutrazol 30 ppm (41.52 cm). Increase in plant spread due to spraying of growth retardants play a vital role in antiauxine activity, disturb carbohydrate metabolism, inhibition of cell division and elongation of apical meristem. Reduction in plant height and produced carbohydrates might be utilized to increase the number of branches and plant spread. Kumar *et al.* (2008) reported that foliar application of Cycocel at 2400 ppm was more effective as it gave highest numbr of leaves plant^{-1} and maximum number of branches plant^{-1} in African marigold. Whereas, significantly maximum plant height (116.44 cm), minimum stem diameter (2.20), branches plant^{-1} (25.20), plant spread (36.43 cm) were recorded in control. Maximum leaf area (56.13 cm^2) was recorded with the application of water spray (control), which was at par with cycocel 1000 ppm (54.06 cm^2), paclobutrazol 20 ppm (53.70 cm^2) and paclobutrazol 30 ppm (52.12 cm^2). Whereas, significantly minimum leaf (49.57 cm^2) area was recorded with the application of paclobutrazol 50 ppm. This might be due to reaction of cycocel with gibberelic acid to lower down the level of diffusible auxin thereby suppressing vegetative growth and ultimately utilized for lateral branching, spread, improving stem thickness and leaf area. However, Shivankar *et al.* (2014) observed that foliar application of cycocel at 1000 ppm had beneficial for increasing number of branches plant^{-1}, stem diameter and plant spread.

Flowering parameters

The control treatment observed significantly early flower bud initiation (38.13) followed by cycocel 1000 ppm (42.26 days). Early opening of flower from bud emergence (16.23 days) reporded in control treatment followed by cycocel 1000 ppm (18.30 days), cycocel 1500 ppm (19.30 days), paclobutrazol 20 ppm (20.20), paclobutrazol 30 ppm (21.23 days). Minimum days required to 50 % flowering were reported in the control treatment (64.23 days) and at par with treatments cycocel 1000 ppm (66.30 days), cycocel 1500 ppm (67.66 days), paclobutrazol 20 ppm (67.16 days) and paclobutrazol 30 ppm (70.00 days). Minimum days required to harvesting of flowers were noticed in control (66.25 days) and at par with treatments cycocel 1000 ppm (68.43 days), paclobutrazol 20 ppm (69.01 days) and paclobutrazol 30 ppm (71.68 days). Control treatment showed early flowering due to early gibberellins production. However, delay flower bud initiation, days to fully opened flower from bud initiation, days to 50 per cent flowering and days to first harvesting from transplanting were recorded with the application of paclobutrazol 50 ppm. Paclobutrazol inhibited the endogenous synthesis of gibberllins responsible for flower bud initiation and hence, delayed flowering. Foley and Keever (1991)

Significantly, maximum number of flowers plant^{-1} (106) was recorded with the application of cycocel at 2500 ppm at par with treatments paclobutrazol at 40 ppm (102.0), cycocel 2000 ppm (100.0), paclobutrazol 30 ppm (96.01). However, minimum number of flowers plant^{-1} (82.06) was recorded in control. Cycocel reacted with gibberelic acid to lower down the level of diffusible auxin thereby suppressing vegetative growth and production of more number of branches or auxiliary shoots with flowers located terminally.Dorajeerao and Mokashi (2012) noticed that foliar spray of cycocel 3000 ppm after 30 DAT recorded maximum number of flowers plant^{-1} (1710.7) However, Munikrishnappa and Chandrashekar (2014) showed that, CCC at 2400 ppm noted delay in flower bud initiation, 50% flowering, highest number of flowers plant $^{-1}$ and smallest flowers. But highest flower weight and yield plant^{-1} and plot^{-1} were recorded with CCC at 2200 ppm in China aster. Vaghasia and Polara (2014) reported that spray of 2000 ppm cycocel increased

Table 1. Growth and flowering of annual chrysanthemum as influenced by cycocel and paclobutrazol

Treatments	Plant height (cm) at 90 DAT	Stem diameter (cm) at 90 DAT	Branches plant^{-1}(cm) at 90 DAT	Plant spread (cm) at 50% flowering	Leaf area (cm^2) at 50% flowering	Days to first flower bud initiation after transplanting	Days to fully opened flower from bud initiation	Days to 50% flowering	Days to first harvesting from transplanting	Flowers plant^{-1} at 90 DAT
T_1- Control	116.44	2.20	25.20	36.43	56.13	38.13	16.23	64.23	66.25	82.06
T_2- CCC 1000 ppm	108.83	2.38	26.26	38.45	54.06	42.26	18.30	66.30	68.43	88.00
T_3- CCC 1500 ppm	104.18	2.48	29.26	40.42	52.60	44.16	19.30	67.66	70.51	94.03
T_4- CCC 2000 ppm	100.40	2.55	30.33	42.86	52.37	46.33	22.43	71.13	74.13	100.0
T_5- CCC 2500 ppm	95.60	2.67	34.26	46.76	51.07	50.23	24.30	74.66	77.81	106.0
T_6- PCB 20 ppm	101.08	2.51	26.20	37.25	53.70	43.13	20.20	67.16	69.01	90.02
T_7 - PCB 30 ppm	96.36	2.58	28.40	41.52	52.21	45.53	21.13	70.00	71.68	96.01
T_8- PCB 40 ppm	95.35	2.61	33.26	44.66	51.38	49.30	23.26	72.90	76.15	102.0
T_9- PCB 50 ppm	92.56	2.66	30.26	39.12	49.57	53.66	25.30	76.13	80.52	93.33
SE (m) ±	3.38	0.07	1.04	1.57	1.168	1.54	1.66	2.29	2.13	3.36
CD at 5%	10.20	0.22	3.15	4.75	3.518	4.66	5.00	6.91	6.40	10.14

*DAT - Days After Transplanting, CCC- Cycocel, PCB – Paclobutrazol

the number of flowers plant^{-1} (29.50) and ha^{-1} (10.66).Foley and Keever (1991) reported that flowering of *Dianthus caryophyllus* (L). and *Dianthus chinensis* (L) was delayed 11 to 14 days due to the paclobutrazol treatment.

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Rec. on 01.05.2016 & Acc. on -02.06.2016