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SEED PRODUCTION IN CHINA ASTER
(Callistephus chinensis (L.) Nees.)

LUCKANA PHETPRADAP

1992
SEED PRODUCTION IN CHINA ASTER
(Callistephus chinensis (L.) Nees.)

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1992
ABSTRACT

Seed production of two cultivars (Powderpuff and Kurenai) of China aster (Callistephus chinensis (L.) Nees.), grown under field conditions, was assessed to determine plant responses to the effects of plant density, crop manipulation by hand pinching and the application of three plant growth regulating chemicals, and some selected herbicides.

Plant density effects on vegetative plant growth, flowering pattern, seed development, seed yield and yield components were investigated in 1987/1988 using a radial spacing design which provided plant densities ranging from 4.2 to 44.7 plants m$^{-2}$. Increasing plant densities increased branch numbers m$^{-2}$ which led to increased leaf numbers, leaf area, plant dry matter and flowers and resulted in an increased number of potential seed production sites. The number of flower heads m$^{-2}$ was the most important component determining final seed yield in both cultivars and was identified as an important plant characteristic to be manipulated for improving seed yield. A period of 18 days was required to complete flowering within each individual flower head, since florets opened sequentially from the outside ring through to the centre. The flowering period lasted for 8 weeks. Each seedhead needed 30 or 39 days from first opening for seed to reach physiological maturity and seeds could remain on the seedhead for a further 9 or 12 days (cv. Kurenai and cv. Powderpuff respectively) before seed shedding started. Kurenai produced maximum seed yield at 27.8 plants m$^{-2}$ (140 g m$^{-2}$) and cv. Powderpuff at 17.4 plants m$^{-2}$ (42 g m$^{-2}$) but these yields did not differ significantly from those over a wide range of densities (between 12.7 to 44.7 plants m$^{-2}$ in cv. Kurenai and 4.9 to 44.7 plants m$^{-2}$ in cv. Powderpuff). Both cultivars exhibited a high ability for compensatory reproductive growth. Lodging and weeds were identified as constraints for seed production at this site and were studied in subsequent years.

A series of experiments were conducted in 1987/1988 and 1988/1989 to evaluate herbicides which would provide good weed control without seed yield reduction, and which would not be phytotoxic to aster plants grown either as transplanted seedlings or when direct sown. For transplanted aster, a single application of oryzalin (3.75 kg a.i. ha$^{-1}$ at 4 days after transplanting) provided excellent weed
control and a tenfold increase in seed yield (to 568 kg ha\(^{-1}\)). For direct sown aster, only trifluralin (2 kg a.i. ha\(^{-1}\)) applied pre-sowing did not significantly reduce aster emergence, while oryzalin (4.5 kg a.i. ha\(^{-1}\) applied 10 days after sowing) provided the best aster seedling survival. However weed control from both chemicals was only partial and further work is required.

In 1988/1989, hand pinching and the application of two different rates of three growth retardants, paclobutrazol (0.5 and 1.0 kg a.i. ha\(^{-1}\)), daminozide (2.5 and 5.0 kg a.i. ha\(^{-1}\)) and chlormequat chloride (1.5 and 3.0 kg a.i. ha\(^{-1}\)) were carried out at two different growth stages (visible terminal bud and stem elongation stages) on cv. Powderpuff to investigate their retardation ability, any alterations in the partitioning of assimilate, and subsequent effects on seed yield and yield components. Powderpuff plant structure was altered by hand pinching only at the visible terminal bud stage. Neither pinching treatment increased seed yield, because, particularly for the earlier pinching time, fewer branches were produced from limited node numbers. The growth retarding effect of the three chemicals was transient and the differences in efficacy and the effective duration of each growth retardant treatment was recorded. The longevity of chlormequat activity in treated plants was short compared to paclobutrazol. Although paclobutrazol and daminozide decreased plant height at seed harvest, lodging was not prevented. None of the three chemicals increased flower head numbers or shortened the duration of flowering, and subsequently failed to increase seed yield. However, paclobutrazol showed enough promise for plant height reduction and seed yield improvement to warrant further investigation.

Two experiments with paclobutrazol were conducted in 1989/1990. The first was on cv. Powderpuff, where two rates of paclobutrazol (0.5 and 1.0 kg a.i. ha\(^{-1}\)) were applied at three growth stages (vegetative, terminal flower bud initiation and first visible terminal flower bud stages) to assess their effects on seed yield. The second was an investigation of cultivar/density responses, where the same two paclobutrazol rates were applied to two aster cultivars grown at two different plant densities (16 and 36 plants m\(^{-2}\) for cv. Powderpuff and 25 and 49 plants m\(^{-2}\) for cv. Kurenai) at the terminal flower bud initiation stage. Paclobutrazol effects on China aster plant height were cultivar dependent. Both paclobutrazol rates effectively controlled plant height of cv. Kurenai but the results in cv. Powderpuff were inconsistent and the plant height reduction was insufficient to prevent lodging.
Results from all the experiments showed that flowering was strongly influenced by environment (daylength and temperature), and since no growth retardant treatments shortened the duration of flowering, a high variation in seed maturity caused by sequential flowering and subsequent high losses of immature seeds during cleaning resulted in no significant seed yield increases. However, paclobutrazol significantly increased potential harvestable seed yield through increasing the number of seeds per plant when applied (i) at the vegetative stage at 1.0 kg a.i. ha\(^{-1}\) to cv. Powderpuff grown at 16 plants m\(^{-2}\) (56 % seed yield increase from 83.8 to 130 g m\(^{-2}\)). (ii) at the terminal flower bud initiation stage at 0.5 kg a.i. ha\(^{-1}\) to late sown plants of cv. Powderpuff grown at 36 plants m\(^{-2}\) (48 % increase from 136 to 202 g m\(^{-2}\)), and (iii) during flower bud initiation and early stem elongation at 0.5 and 1.0 kg a.i. ha\(^{-1}\) in cv. Kurenai grown at 49 plants m\(^{-2}\) (32 and 42 % increase from 178 to 236 and 253 g m\(^{-2}\) for the low and high rate respectively).

Seed production problems and possibilities for the production of China aster seed under New Zealand and Thailand conditions are also discussed.
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