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Flower Abscission Responses of *Capsicum* Cultivars to Treatment with Growth Substances

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Flower abscission responses to hormonal treatment in NP 46-A and Pusa Jwala cultivars of *Capsicum annuum* L. were investigated under pot and field conditions. Synthetic auxin (NAA), cytokinin (BA) and morphactin (CME) reduced the flower drop while gibberellic acid (GA), ethephon (ETH), abscisic acid (ABA) and ascorbic acid (AA) promoted flower drop in the cultivars. The growth substances were effective when applied at preflowering stage. Auxin in combination with cytokinin and morphactin additively retarded flower abscission. Ethephon and abscisic acid showed additive interaction in promoting flower drop. Responses to combinations of abscission retardants and accelerants varied according to the stage of growth of plants at the time of treatment.

Key Words - Abscission Flower Hormone Morphactin

Capsicum annuum **plants suffer substantial loss in yield due to flower and fruit drop even if the crop is grown under the ideal condition (Singh, 1979). Purseglove (1974) pointed out that no remedial measures are known to reduce this loss. The use of plant growth regulators for the control of flower drop has yielded promising results in some solanaceous plants (Veliath & Ferguson, 1973; Read, 1982). However, information on chilli, particularly under Indian agroclimatic conditions is lacking. Therefore, an experiment was conducted to study the effect of Combinations of growth regulators on flower abscission of chilli cultivars.**

MATERIALS & METHODS Plants of NP 46-A and Pusa Jwala cultivars of pepper were raised in pots (vegetative stage treatment - VST) and field (full bloom stage treatment-FST) following the standard horticultural practices (Singh, 1979) from June to October of 1977 & 1978.

In VST trials, each pot had 4 equidistant and healthy plants with 12th leaf fully unfolded at the time of treatment (45 day old plants). Five such pots were grouped together to constitute a single block of randomized block design of experimental pattern. Each treatment (individual PGRs as well as their combinations) was replicated twice. The details of treatments were already described (Singh & Murty, 1984). The treated plants were allowed to develop up to flowering, fruiting and maturity stage and the effects of various treatments were studied on flower abscission pattern.

In FST trials, plants were raised in the field having sandy loam soil which was characterized by pH - 7.55, EC - 1.95 m mhos/cm, OC(%)-0.35, available N-171 kg/ha, available P-021 kg/ha and available K-139.5 kg/ha. Treatment blocks (2x2M) had 81 healthy and vigorously growing plants (spaced 25 cm x25 cm). The experimental design was same as adopted for VST trials. Full bloom stage was considered at F.50 (i.e. when at least 50 flowers had developed on control plants). This stage was attained at 91 days in both the genotypes. Ten plants in middle rows of each block were randomly selected and numbered 1-10. Aqueous solutions (prepared in Tween 20 as a surfactant) of different combinations were sprayed to run off on the entire block with the help of a pneumatic hand sprayer. The number of flowers produced and retained on sampled plants was recorded just before and after a gentle shake up at an interval of 4 days till the number became

constant. Per cent flower abscission was later calculated based on total number of flowers produced during the cropping season. This method was originally used by Veliath & Ferguson (1975) in tomato. As the results obtained during 1977 and 1978 were identical, the Figure 1 represents the pooled average of results. The data were statistically analysed (Chandel, 1978).

RESULTS & DISCUSSION General Despite optimum soil fertility (as maintained on the basis of soil analysis and supplementing the soil with recommended doses of FYM) and proper irrigation scheduling, flower abscission percentage exceeded 40% in NP 46-A and Pusa Jwala under pot and field conditions. However, control plants did not differ significantly from each with respect to their flower abscission pattern (Fig. 1). NAA (100mg/L), BA (20 mg/L) and CME (20 mg/L) reduced the flower drop percentage even when applied at preflowering stage. When applied at full bloom stage, even 20 mg/L of NAA reduced flower drop up to the same extent as shown by 100 mg/L of NAA in VST trials. The flower abscission percentage was enhanced by GA, ETH, ABA and AA when tested individually either in VST or FST trials.

Response to Abscission Retardants

NAA and BA when applied in combination induced a substantial retardation of flower drop in both varieties. The combination was more effective when tested at full bloom stage. The interaction of NAA and BA was additive in deferring the process of flower abscission (Fig. 1). Furthermore, some of the adverse effects of individually tested NAA (such as reduction of total number of flowers formed) were not observed when BA was added to NAA solution. NAA also showed additive effect with CME in decreasing the flower abscission. In FST method, Pusa Jwala was more responsive than NP 46-A to NAA + CME treatment. The deformities in vegetative and reproductive parts as observed in plants treated with CME alone, did not appear in response to combinations like NAA + CME and BA + CM. Cytokinin and morphactin (CME) combination was most potent retardant of flower abscission irrespective of cultivar or mode of treatment. The flower drop percentage declined up to 5% (Pusa Jwala) and 6% (NP 46-A) when treatment was given at full bloom stage (Fig. 1). Schneider (1972) with tomato, and Halevy & Kofranek (1976) with rose obtained similar results. According to Addicott (1981), synergistic and additive interaction of auxins with cytokinins and morphactins in reducing flower drop was by delaying the senescence process.

Responses to Abscission Accelerants

Gibberellin and ethephon promoted flower drop when applied at full bloom stage in both the cultivars. Though, the promotory effect of GA + ETH combination applied at vegetative stage was evident in flower abscission, the interaction was not additive. In combination with ABA, GA promoted flower drop in VST as well as FST trials but the effect was additive only in FST trials (Fig. 1). NP 46-A was more responsive than Pusa Jwala to GA + ABA combination. The stem elongation effect of GA was, however, countered by ABA when tested in combination. GA + AA combination was not additive in promoting flower drop. Ethephon in combination with ABA additively accelerated flower abscission but defoliation of tender leaves did not occur (Fig. 1). ETH + ABA combination was most effective in promoting flower drop in NP 46-A and Pusa Jwala varieties treated either at vegetative or full bloom stage. Similar results were obtained by Veliath & Ferguson (1973). Jacobs (1979) reported that the abscission acceleration by ETH alone or in combination with ABA, AA and GA (high dose) was caused primarily by the enhanced activity of cellulase in abscission zone of vegetative and reproductive structures.

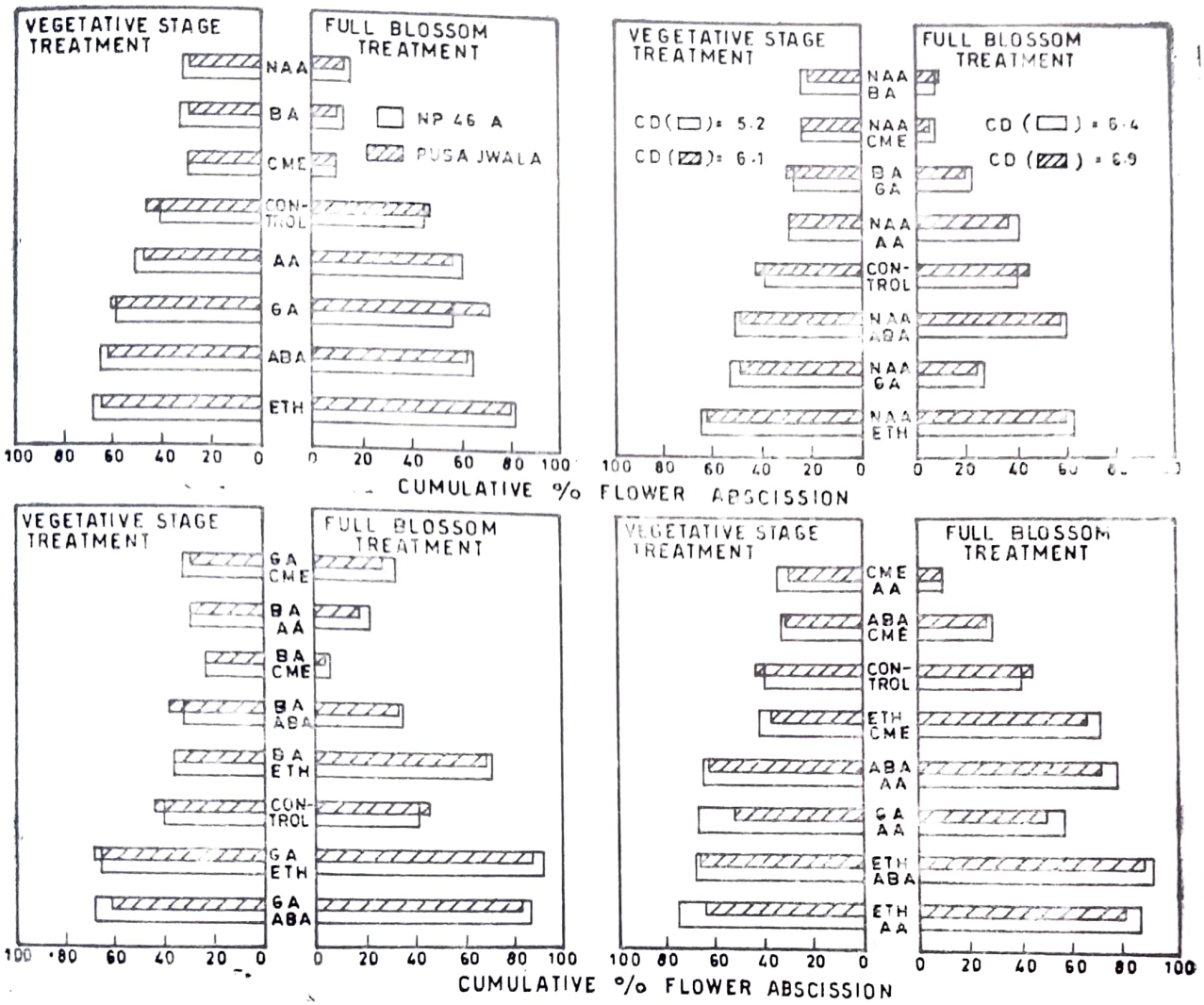

Fig 1 Flower abscission percentage of NP 46-A and Pusa Jwala cultivars of *Capsicum annuum* treated with auxin (NAA), cytokinin (BA), morphactin (CME), gibberellic acid (GA), ethephon (ETH), abscisic acid (ABA) and ascorbic acid (AA), individually and in combination.

Responses to Combination of Retardants and Accelerants In combination where abscission retardants were simultaneously applied with accelerants, evidences of various interactions were obtained. Synthetic auxin (NAA) had partially countered the strong abscission promoting effect of ETH and ABA in both the varieties. NAA (20 mg/L) and AA (200 mg/L) when tested in combination in FST trials countered or antagonized the opposite effects of each other on flower drop percentage which was similar to control in *Capsicum* cultivars. In VST trials, NAA + GA combination accelerated flower abscission but promotory effect of GA was slightly reduced by NAA application. In FST trials, the flower abscission process was retarded (contrary to the effect in VST method) by NAA + GA combination (Fig. 1). Pusa Jwala was more responsive than NP 46-A to abscission deferring action of auxin and gibberellin combi-

nation. GA partially countered the effect of NAA. This antagonistic action of GA was evident from the study of some side effects of individually applied NAA. The reduction of total number of flowers induced by individual NAA treatment, was not observed when GA was added to the solution. The interpretation of results of NAA and GA interaction in the process of flower abscission is difficult because opposite effects of NAA + GA combination were observed in VST and FST methods of treatment. Results of NAA application with other accelerants are in agreement with the findings of Campbell (1976) who worked with tomato.

The flower abscission retarding effect of BA was partially countered by GA in FST trials. In VST trials, BA and ETH appeared to antagonize the opposite effects of each other. However, in FST trials, ETH dominated over BA as evident from an enhancement of flower drop percentage by ETH + BA combination. In combination with ABA and AA benzyl adenine dominated in action as evident from retardation of flower drop by BA + ABA and BA + AA combinations irrespective of the mode of treatment (Fig. 1). These results support the findings of Fletcher & Addipe (1972) who experimented on bean and peach, respectively.

The long lasting effect of morphactin (CME) was well pronounced compared with other flower abscission retardants tested in combination with accelerants. Ascorbic acid failed to affect the strong abscission defering action of morphactin in NP 46-A and Pusa Jwala cultivars under VST as well as FST trials. GA countered the abscission retarding effect of CME only when tested by FST method. ABA countered though partially, the action of morphactin in both varieties (Fig.1). In VST trials, the flower drop percentage was similar to control plants in response to treatment with CME + ETH combination. This indicated that CME and ETH exerted along lasting antagonistic action against each other. However, in FST method, ETH dominated over CME which countered the strong abscission accelerating effect of ethephon only partially. NP 46-A was more responsive than Pusa Jwala to ETH action even in ETH + CME combination. Growth abnormalities induced by individually applied CME, were not observed in plants treated with combinations like CME + ETH and CME + ABA. Though, the mode of action of morphactin in abscission is yet to be understood (Parups, 1983). Singh & Murty (1984) using whole plant system and Singh & Murty (1984) using explant system obtained similar effect of CME on foliar abscission. Schneider (1972) and Corcoran (1975) reported that some of the morpho-physiological effects of morphactins could be reduced or completely countered by the addition of gibberellin or ethylene to the solution.

On the basis of our studies, we recommend that NAA (20 mg/L) and BA (20 mg/L) combination can be used at full bloom stage to reduce flower drop. Combinations like CME + NAA and CME +BA are effective. Abscission accelerating combinations like ETH + ABA or ETH + AA can be applied at a later stage to hasten the maturity of fruits.

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