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Nipping - A Simple Strategy to Boost The Yield - Review

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Nipping is an important practice that removes the apical dominance and promotes the lateral branches which in turn improves the yield of crops. It plays a vital role for better maintenance of source and sink relationship and for ameliorating the productivity. Nipping can be done in two ways either by clipping manually or by spraying growth retardants such as mepiquat chloride, chlormequat chloride and maleic hydrazide. In this review, the influence of nipping on the growth and yield of various crops has been discussed.

Keywords: Nipping; yield of crops; low yields; growth retardants.

1. INTRODUCTION

The factors that are mainly responsible for the low yields in any crop are unsatisfactory cultural practices, the inconsistency of monsoon, low fertility in soils, insufficient quality seeds *etc*. Hence, there is a need to standardize the agronomic practices for realizing the yield potential. Nipping is an important agronomic practice which arrests the apical growth and boosts the lateral branches that subsequently improves the number of pods. Hence nipping plays an important role for better maintenance of source and sink relationship and for ameliorating the productivity. Though nipping has been done majorly in pulses, it has a vast scope in other

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crops also. Time of nipping in short duration crops vary based on duration from 30 - 40 days after sowing and in cotton it will be around 70 - 90 days of sowing. Infield pea, nipping at 35 DAS of the crop could enhance the number of branches by confining profuse vegetative growth and thereby improving the crop yield [1]. In *Vicia faba*, topping at early flowering and pod filling stage resulted in increased seed yield [2]. Nipping can be done in two ways, by manual nipping and by chemical methods. Manual nipping can be done by pinching the terminal portion of the crop. Chemical nipping can be done by using growth retardants like Mepiquat chloride and Chlormequat chloride.

Mepiquat chloride (N, N-dimethyl piperdinium chloride) is a growth retardant, which is mainly used in cotton that restricts the synthesis of gibberlic acid and inhibits the apical dominance which gives rise to lateral buds, hence, the number of branches will be increased. Mepiquat chloride as a growth regulator is known to suppress vegetative growth in cotton which was proved by York [3]. Similarly, Chlormequat chloride (Cycocel, CCC) is a synthetic growth retarding chemical that is mainly used for dwarfing in plants. Increasing Cycocel concentration leads to a rise in the yield of cotton [4].

Nipping on morpho-physiological characters: Pinching of the terminal bud results in a reduction of plant height over no nipping. In pea, Singh and Singh [5] found that the plant height was affected by nipping at 60, 75, 90 DAS and harvest and maximum plant height was observed over no nipping which is supported by Sharma et al. [6] in pigeon pea, Reddy [7] and Reddy et al., [8] in cowpea and Baloch and Zubair [9] in Chickpea. Similarly, reduced plant height was observed by Dhital et al. [1] with primary nipping at 30 DAS followed by secondary nipping at 40 DAS in fieldpea.

In coriander reduced plant height had resulted in terminally clipped plants and improved number of branches [10] which was supported by Kithan and Singh [11] in sesamum.

Morphophysiological parameters such as dry matter production, crop growth rate, relative growth rate nipped plants showed superiority over no nipping in sesamum [12] which was supported by Duary and Ghosh [13] in summer sesamum and Srinivasan et al. [14] in redgram.

2. GROWTH RETARDANTS

Increased leaf area and leaf area index were reported by spraying growth retardants like 750 ppm of CCC and 150 ppm mepiquat chloride in potato which was found by Madalgeri and Ganiger [15]. Reddy and Patil [16] stated that in irrigated groundnut, a foliar application of 1000 to 2000 ppm CCC at 60 DAS momentously reduced the plant height, but the increased leaf thickness, leaf area index (LAI), rate of dry matter and total dry matter per plant were recorded.In contrast to this, a reduced leaf area index was observed in case of soybean by Jaidka et al. [17]. Similar to manual nipping mepiquat chloride reduces the plant height which was observed in soybean by Jaidka et al. [17] but the difference failed to show the significant variation among nipping and no nipping. Application of chlormequat chloride results in the curtailment of gibberellin synthesis, which leads to reduced plant height over-controlled plants. Reduced plants height was observed in okra with chlormequat chloride with a concentration of 500 ppm and 2000 ppm [18] and these results were supported by Dorrell [19] in sunflower.

Improvement in total dry matter production, tillering and crop growth rate by the application of lihocin was reported by Choudhary and Suri [20] in rice crop. In soybean crop, Fujii and Saka [21] stated that the application of brassinosteroid improved the source and sink relationship and the other interactions which occur endogenously. Even, the brassinosteroids improve the source and sink relationship in soybean [21]. A noted increase in the dry matter production of soybean was observed with the application of mepiquat chloride 88 SC and cyclanilide 22 SC. Mepiquatchloride is majorly applied to avoid more vegetative growth and to prevent yield loss [22]. He reported that the yield parameters such as boll setting percentage were improved with the application of mepiquat chloride whereas, the dry matter production was decreased.

The increased leaf area index is observed with the application of growth retardants which might be due to more number of leaves [7]. Similarly, an increase in number of leaves, number of branches and LAI over the control by spraying mepiquat chloride 120 ppm which was recorded by Prakash et al. [23] in black gram. Rajesh et al. [24] reported that in greengram the leaf area index was increased gradually from 30 to 60 DAS and after that LAI is decreased due to aging and

senescence of the leaf. Among the growth retardants, the higher leaf area index was recorded with mepiquat chloride compared to chlormequat chloride

In addition to LAI, the physiological parameters such as crop growth rate, relative growth rate, net photosynthesis also improved with the application of growth retardants. In green gram, crop growth rate was higher during 60-75 DAS and it was greatly increased with the application of mepiquat chloride @ 375g a.i. ha^{-1} followed by brassinosteroid 20 ppm as reported by Rajesh et al. [24] which was supported by Partovian et al. [25] in safflower and Paikra et al. [26] in soybean. Similarly, in the case of chlormequat chloride, Chikkappiah and Meena [27] found that the application of chlormequat chloride at a rate of 1000 ppm increased various growth parameters such as relative growth rate compared to control and all other treatments.

3. NIPPING ON YIELD ATTRIBUTES

Clipping of the terminal bud leads to the development of lateral buds that in turn produces more number of lateral branches. More number of branches were observed by Sajjan et al. [28] in okra by pinching at 20 DAS. Similarly, a maximum number of branches were observed in chickpea by nipping at 45 DAS by Aziz [29]. An increased number of branches, enhanced dry weight, seed yield (12.50 q ha^{-1}) and higher protein content wa s observed in nipped plants of cowpea over no nipping by Prashant [7]. Similar results were observed with Aslam et al., [30] where a maximum number of pod bearing branches, total dry matter and maximum crop growth rate at maturity were higher in nipped plots over no nipping in chickpea. These results were in line with Thakral et al. [31] in coriander and Menon and Khader [32] in coriander and Sudarshan [33] in fenugreek.

Increased number of pods, early pod setting and reduced pod shedding were observed with topping at pod filling stage which was observed by Huang [2] in Viciafaba. He also found that the plants topped at before and later flowering stage produced 3.6 per cent lower seed yield compared to topping at peak flowering stage. In sunflower, an improved yield was obtained by nipping which was reported by Shankaregouda and Patil [34]and these results were supported by Kubsad et al. [35] and Vyakaranahal et al. [36]. Influence of nipping in gram Cv. Dohad yellow was studied by Patel and Patel [37] and concluded that the yield attributing characters like pods $plant^{-1}$ and seed yield $plant^{-1}$ were increased due to nipping and the improved yield might be because of higher number of pods $plant^{-1}$, test weight and seed weight $plant^{-1}$. In sesamum more number of capsules were observed with nipping by Venkadachalam [38] similarly, in cotton increased number of sympodial branches, bolls and seed cotton yield were observed due to nipping by Obasi and Msaakpa [39] and these results were in line with Reddy [40], Kokilavani [41] in sesamum.

4. GROWTH RETARDANTS

Similar to manual nipping the application of growth retardants also produces more lateral buds that in turn produces more lateral branches which were supported by Rajesh et al. [24] in greengram, where he observed an increased number of branches with the application of mepiquat chloride @ 162.5 g a.i./ha and chlormequat chloride @187.5 g a.i./ha. Sudhakar and Rani [42] observed non-significant difference among the treatments for the morphological characters like plant height, number of branches *i.e.,* primary and secondary branches with the application of mepiquat chloride and NAA in redgram. Similar results were observed by Jeyakumar et al. [43] in blackgram variety ADT5 with the application of mepiquat chloride 125 ppm. In fenugreek, Lakshmi et al. [44] reported that malic hydrazide @ 500ppm produced the maximum number of pods $plant^{-1}$, pod yield $plant^{-1}$ and pod yield per $hectare^{-1}$ which was followed by nipping. These results were in acceptance with the findings of Thakral et al. [31] in coriander, Baboo and Rana [45] in clusterbean, Sajjan et al. [28] in okra and Gill et al. [46] in fenugreek and Basha and Reddy [47] in summer sesame.

Yield: Shivaramu and Krishna Murthy [48] observed an improved yield was observed with nipping in castor over no nipping. Similarly, maximum yield was observed in chickpea with nipping [9], these results were in line with Sujatha et al. [49], Sonboir et al. [50] in chick pea. Due to pinching and micro nutrient mixture foliar spray (ZnSO4 0.5% + Boric acid 0.3%) in dhaincha, Nayak et al. [51] observed an improvement in the seed yield. Srinivasan et al. [14] reported 25.8% increase in the seed yield in nipped redgram plants over no nipping. Similarly, 33% increased yield was observed in horsegram by nipping at tendril initiation stage by foliar

spraying of mepiquat chloride 250 ppm which was reported by Bhavana et al., [52].

Application of growth retardants and nipping notably increased the yield attributes such as number of pods, pod length, number of seeds pod^{-1}, 100 seed weight and harvest index (HI) which was reported by Reddy [40] in cowpea. In cotton, improved yield was observed with application of mepiquat chloride [53]. There is a huge demand for chemicals in castor to avoid excessive vegetative growth and to defoliate the leaves for making the crop ready for harvest.

In addition to improved yield growth retardants plays an important role in enhancing the quality of the produce. The protein content of the plants notably higher with mepiquat chloride treated plants than that of water treated plants which was reported by Singh and Kler [54]. In groundnut, protein content was improved with the application of mepiquat chloride at rate of 0 -150 ppm [55]. These results were in line with the Zaky et al. [56] and Senthil [57] in greengram. Similarly, in vegetable cowpea Seed protein content was non- significantly influenced by the growth regulators *viz.,* CCC, MH and TIBA. Foliar application of mepiquat chloride 200 ppm at 45 and 60 days after sowing significantly influence the root parameters, number of symbodia, bolls per plant and boll weight of cotton [58].

Economics: Srinivasan et al. [14] reported higher gross and net returns by nipping in redgram in comparison with no nipping. With respect to growth retardants, application of chlormequat chloride in soybean produced superiorly higher B:C ratio (1.99) compared to control [59]. Sudhakar and Rani [42] stated that application of mepiquat chloride 2000 ppm in redgram observed higher benefit cost ratio which eventually increased the seed yield up to 42.5 per cent and these results were in line with Arora et al. [60], Kiran Kumar et al. [61].

5. CONCLUSION AND RECOMMENDATION

By suppressing the domination of apical bud, nipping boosts the yield of crops as it improves the lateral branches. Nipping is considered as the best agronomic practice to improve the yield of the crops not only in pulses but also in other crops such as viz., cotton, sesamum, castor, okra, fenugreek and coriander.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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