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Nipping for Enhancing Chickpea Yield: A Review

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ABSTRACT

Chickpea is an important crop in the cropping pattern supplying cheap protein diet especially for poor people. Over the years, however, low yields are more prominent declining acceptability of this crop. Apart from other production enhancement indicators, nipping appeared to be a factor increasing yield contributing parameters and yield. In chickpea, 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 important physiological role for balancing of source and sink relationship and for enhancing the productivity as well. In this review, the effect of nipping, its timelogy, methods on the growth, yield attributes and yield of chickpea has been discussed.

Keywords: Nipping, chickpea, growth, yield

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. Nipping in known by various names i.e. pluncking, pinching, detopping, clipping, nibbling. etc. is the apical buds of crop at appropriate time preferably at 30-40 DAS in chickpea is done to stop the apical growth. It promotes the lateral branching and plants become more vigorous and produce more flowers, pods which resulted in higher yield per plant and ultimately more total seed yield. Hence, nipping plays an important role for better maintenance of source and sink relationship and for ameliorating the productivity. Chickpea is an economical source of quality protein of food. Chickpea has nitrogen fixation properties which is plays an important role in maintenance of the soil fertility, particularly in the arid and low rainfall areas as chickpea being cropped under crop rotation .Chickpea is also known as gram, Bengal gram, garbanzo bean, and sometimes known as Egyptian pea, ceci, ceceor chana. Chickpea (*Cicer arietinum* L.) belongs to the family Leguminaceae is an important winter season pulse crop having extensive geographical distribution. Chickpea (*Cicer arietinum* L.) is an important pulse crop grown and consumed all over the world, especially in the Afro-Asian countries. Its protein quality is better than other legumes such as pigeon pea, black gram and green gram . Chickpea contains protein 21%, carbohydrate 61%, fiber 3%, oil 4.8-5.5, calcium 0.2%, phosphorus 0.3%, ash 3%, and 0.12-0.33 mg riboflavin . There are wide variations in the agroclimatic conditions under which chickpea is grown around the world. It is grown between 20°N and 40°N in the northern hemisphere. It is also cultivated on a small scale between 10°N and 20°N in India and Ethiopia at relatively higher elevations. These environments differ in photoperiod, temperature, and precipitation. Due to the variation in longitude, the time of sowing also varies from one region to another. It has been classified chickpea-growing areas into four major geographical regions. a. Indian subcontinent b. West Asia, North Africa, and Southern Europe c. Ethiopia and East Africa d. The Americas and Australia it was listed the major agroclimatic constraints to production and productivity of chickpea [8,9,10]. In the alluvial soils of the Indo-Gangetic plain, chickpea follows rainy-season crops such as pearl millet, sorghum, maize, sesame, and early paddy in double-cropping systems. In sandy soils in northern India (the states of Punjab, Haryana, and Rajasthan) and the 'Thai' areas of Pakistan, it is grown either after pearl millet or after fallow when monsoon rains are insufficient. In central and peninsular India, chickpea is also grown in rotation with sugarcane and maize. Chickpea is mainly grown as a mixed crop with oilseeds such as rape-seed, mustard, taramira (*Eruca sativa* Mill.), and linseed. It is also grown as a mixed crop with barley and lentil in northern India .

Time of nipping: The tips of the young branches of chickpea plants when it is 20-25 cm high, should be removed by any means. This results in increase in number of branches per plant and better crop yield. Nipping should be completed within 30-40 days after sowing[19]. Time of nipping in short duration crops vary based on duration from 30 - 40 days after sowing In field 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 chickpea, topping at early flowering and pod filling stage resulted in increased seed yield [2].

Methods and effect of nipping: Nipping can be done in many ways: mannual nipping – Manual nipping can be done by pinching the terminal portion of the crop, mostly done by the labours and the de-topped portion is either used for making chana vegetable, parathas and dried for use in summers also.

Animal Nipping: a herd of goats or sheeps are runs though the field quickly and these goats eats the top portion of chickpea. It is most popular and cost effective method of nipping. Mechanical nipping: now a days some mechanical devices are used to cut the top portion of chickpea.

Chemical nipping: some of the chemicals are used which acts as growth retardants or enhance branching in chickpea to some extent. 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. Similarly, Chlormequat chloride (Cycocel, CCC) is a synthetic growth retarding chemical that is mainly used for dwarfing in plants. Nipping on morpho-physiological characters: Pinching of the terminal bud results in a reduction of plant height over no nipping. In chickpea, 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*. 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 chickpea. In chickpea reduced plant height had resulted in terminally clipped plants and improved number of branches [10] which was supported by Kithan and Singh [11] in plant. Morph physiological parameters such as dry matter production, crop growth rate, relative growth rate nipped plants showed superiority over no nipping in chickpea [12]. Nipping in chickpea is one of the important parameter for the enhancement of the yield and yield contributing parameters. Indian chickpea one of the most important oil crops at national and international level, very little research work has been undertaken to study the subject. Chickpea is an important pulse crop in the cropping pattern supplying cheap protein diet. The Krishi Vigyan Kendra, Kalaburagi has conducted frontline demonstrations on farmer fields in adopted villages to study the effect of nipping on seed yield of Chickpea(TS-3R). The results revealed that nipping of the terminal bud in between 45 to 50 days of crop growth stage significantly reduced the height of the plant and increased the number of primary and secondary branches and pods per plant. The nipping operation of chickpea crop has given yield increased of 19.59, 17.39 and 14.37 per cent during 2016, 2017 and 2018, respectively over check. The nipping practice in chickpea resulted in increased an average three year yield of 13.24 q/ha over check plot (11.28 q/ha). The changes will accelerate the adoption of nipping technologies to increase the productivity of chickpea in this area. There is a need to adopt multi pronged strategy which involves enhancing chickpea production through horizontal and vertical expansion and productivity improvements[1,2]. 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. 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 per plant were increased due to nipping and the improved yield might be because of higher number of pods plant-1, test weight and seed weight per plant. Similarly, maximum yield was observed in chickpea with nipping [9], these results were in line with [21,22] in chickpea.

Manual Nipping in Chickpea (Photo from: ISA news letter

Mechanical nipping

Apart from other production enhancement indicators, nipping appeared to be a factor increasing yield and yield contributing parameters. To investigate the appropriate nipping technique as well as to sort out combination of spacing and nipping, an experiment was conducted during 2008-09 with chickpea variety NIFA-2005. Nipping was done on four different crop growth stages viz. nibbling (topping), harvesting at 4" level, harvesting at ground level and control (no nipping) with rows 40 and 50 cm apart. Among the parameters studied, number of plants/plot, plant height and grain yield appeared statistically significant across nipping methods and row spacing whereas number of pods/plant, number of grains/pod and 1000-grain weight were found non-significant. Control plot produced tallest plants (78.80 cm) whereas maximum yield (1792 kg/ha) was obtained in nipping at ground level with rows 40 cm apart. The research concluded that nipping is a profitable practice for chickpea growers.An appropriate nipping technique as well as to sort out combination of spacing and nipping, an experiment was conducted during 2008-09 with chickpea variety NIFA-2005. Nipping was done on four different crop growth stages viz. nibbling (topping), harvesting at 4" level, harvesting at ground level and control (no nipping) with rows 40 and 50 cm apart. Among the parameters studied, number of plants/plot, plant height and grain yield appeared statistically significant across nipping methods and row spacing whereas number of pods/plant, number of grains/pod and 1000-grain weight were found non-significant. Control plot produced tallest plants (78.80 cm) whereas maximum yield (1792 kg/ha) was obtained in nipping at ground level with rows 40 cm apart. The research concluded that nipping is a profitable practice for chickpea growers.

Growth and yield of chickpea is affected by detopping practice. Seed yield was maximum when chickpea plant (var. BARI Chola-10) is de-topped after 50 DAE (Days After Emergence) at 5 cm from growing tip followed by highest marginal benefit cost ratio. The treatment was comprised of foliar spray of naphthalene acetic acid (NAA), maleic hydrazide (MH) and nipping along with untreated control. NAA 50 ppm and MH 60 ppm concentrations and nipping were used in experimentation. Observations were recorded at 30, 50, 70 DAS and maturity. The observations had been studied on biochemical, yield and yield attributes parameters of the JG-14. Foliar spraying of naphthalene acetic acid, maleic hydrazide and nipping at 30 and 50 DAS were performed well. It is concluded from the result that foliar application of NAA 50 ppm at 30 and 50 DAS and nipping at 30 and 50 DAS were found increase the all parameters of plant like total chlorophyll content, nitrate reductase activity, protein content in seed, leaf nitrogen content, total phenol content, number of pod per plant, pod weight plant-1, 100 number of seed plant-1, seed weight plant-1, grain yield (g) plant-1, grain yield quintal hectare-1 and harvest index followed by foliar application of NAA 50 ppm at 30 DAS and nipping of shoot at 30 and 50 DAS respectively except plant height.[3,4].

The treatments consisted with nipping and NAA 50 ppm, maleic hydrazide 60 ppm, along with untreated control. Solutions of plant growth regulators were prepared on weight by volume basis in desired concentration. The seeds of chickpea variety JG-14 were sown and after germination of seeds, thinning was done at 20 DAS to maintain proper distance and population in each plots and weeding was done as per requirement to control the weeds. Solutions of different plant growth regulators were prepared at the time of foliar spray, while untreated control was sprayed with distilled water. [5,6,7].

Detopping of upper 2 cm growing tips with supply of irrigation at 80 % depletion of available soil moisture in chickpea crop positively affected different agronomic parameters such as the number of pods plant-1, number of seeds pod-1 and 100 seed weight which ultimately contributed to increased biological yield, grain yield and harvest index. In this way, initiation of lateral reproductive branches of plants and increased pod setting with judicious use of irrigation water is expected and furthermore, it would minimize the lodging problem with 37 % saving of irrigation water. Therefore, irrigation at 80 % available soil moisture depletion level and light grazing is recommended at particular growth stage (December-January) to control chickpea plant height and to obtain the maximum grain yield. Among the parameters studied, number of plants/plot, plant height and grain yield appeared statistically significant across nipping methods and row spacing whereas number of pods/plant, number of grains/pod and 1000-grain weight were found non-significant. Control plot produced tallest plants (78.80 cm) whereas maximum yield (1792 kg/ha) was obtained in nipping at ground level with rows 40 cm apart. The research concluded that nipping is a profitable practice for chickpea growers.[17].

Nipping in chickpea is one of the important techniques for the enhancement of yield. Nipping at various stages tended to enhance number of branches and number of pods that in turn boost chickpea yield . Nipping practice in the research area has two fold advantage i.e. one hand nipping at prescribed growth stages could improve yield of the crop while on the other hand during time the chickpea in the field is usually a shortage of fodder and poor farmers could not afford to buy forage at distant locations, so chickpea may provide them an opportunity to fetch green fodder for their livestock. Biochemical changes i.e., chlorophyll content in leaves, nitrogen content in leaves and nitrate reductase activity in leaves were studied at 30, 50 and 70 DAS and total phenol content were studied at 50 and 70 DAS, while protein content was determined in mature seed, finally their effects were evaluated with yield and yield components. Overall, it was observed that the application of naphthalene acetic acid 50 ppm at 30 and 50 DAS (T5) was found most effective for increasing the total chlorophyll, nitrate reductase, protein content in seed, total phenol content, number of pods per plants, pods weight per plants, number of seeds per plant, seed weight per plants, 100 seed weight, seed yield (g) per plant and seed yield q ha-1. Thus, it can be concluded that foliar application of NAA 50 ppm at two times favoured overall improvement in characters which were highly linked with yield. Nipping or cutting back chickpea at various levels would enhance yield and yield contributing parameters of this crop. Present research findings revealed a case in favor of nipping that not only increased yield as well supplying fodder at times when there is scarcity of green forage in the area. Since this crop is characterized as crop with minimal input resource applications, higher yields can certainly fix its place in cropping schemes both in low and high productive land use systems (Baloch and Zubair).There is a general belief that nipping of foliage at an early stage induces more branching, restricts profuse growth, and leads to a higher yield.[11,12]. An experiment was carried out regarding the combined effect of nipping as well as foliar applied fertilizers on yield and yield components of chickpea under rain-fed conditions. Nipping and foliar application of nutrients significantly improved number of pods plant^{-1}, biological yield (kg ha^{-1}), harvest index (%) and final grain yield (kg ha^{-1}). However, non-significant influence was seen in 1000-grain weight and number of grains pod^{-1}. Foliar application of N PK (20:20:20) @2.5 kg ha^{-1} × nipping was found to be the best interaction among others which significantly increased number of branches plant^{-1} (11.30), number of pods plant^{-1}(115.36), plant height(59.48cm) and grain yield(2338.9 kg ha^{-1}) as compared to the control treatment. Nipping along with foliar application of NPKcan be practiced in chickpea for higher profitability.[14]. Although, chickpea is nitrogen fixing crop but water scarcity under rain-fed condition reduces its nodulation process severely and nutrients use efficiency too. Nipping and foliar application of NPK improved grain yield. Nipped plants which received foliar spray of NPK2 produced higher grain yield (2338.9 kg/ha) while lower grain yield (1111.1 kg/ha) was recorded in nipped plants where no foliar spray of NPK was used. This practice increases the germination percentage of the harvested seed, and does not have any effect on the milling and cooking quality of the seed. The crop should be harvested when leaves start senescence and shedding. The plants are harvested at the base by manual labor, using a sickle or by using a combine harvester. After harvest, the crop is allowed to dry in the sun for a few days. Threshing is done either by beating the plants with sticks or with a thresher. Traditionally, farmers thresh their crop by trampling it with bullocks, camels, or horses. In this process, the dried crop is spread in a circle of about 15 m2 . The tractor or bullocks are allowed to walk on the plants in circles for an hour or more depending on the amount of material to be threshed. Continuous stirring of material at intervals of 15 to 20 min is required for uniform threshing. For easy threshing and to avoid damage to the seed, it is better to take out the seed from the threshing lot when about 60-70% seeds have separated from the straw.

Discussion

The treatment was comprised of foliar spray of naphthalene acetic acid (NAA), maleic hydrazide (MH) and nipping along with untreated control. NAA 50 ppm and MH 60 ppm concentrations and nipping were used in experimentation. Observations were recorded at 30, 50, 70 DAS and maturity. The observations had been studied on biochemical, yield and yield attributes parameters of the JG-14. Foliar spraying of naphthalene acetic acid, maleic hydrazide and nipping at 30 and 50 DAS were performed well. It is concluded from the result that foliar application of NAA 50 ppm at 30 and 50 DAS and nipping at 30 and 50 DAS were found increase the all parameters of plant like total chlorophyll content, nitrate reductase activity, protein content in seed, leaf nitrogen content, total phenol content, number of pod per plant, pod weight plant-1, 100 number of seed plant-1, seed weight plant-1, grain yield (g) plant-1, grain yield quintal hectare-1 and harvest index followed by foliar application of NAA 50 ppm at 30 DAS and nipping of shoot at 30 and 50 DAS respectively except plant height.[3,4].Nipping at various stages tended to enhance number of branches and number of pods that in turn boost chickpea yield . Nipping practice in the research area has two fold advantage i.e. one hand nipping at prescribed growth stages could improve yield of the crop while on the other hand during time the chickpea in the field is usually a shortage of fodder and poor farmers could not afford to buy forage at distant locations, so chickpea may provide them an opportunity to fetch green fodder for their livestock. Biochemical changes i.e., chlorophyll content in leaves, nitrogen content in leaves and nitrate reductase activity in leaves were studied at 30, 50 and 70 DAS and total phenol content were studied at 50 and 70 DAS, while protein content was determined in mature seed, finally their effects were evaluated with yield and yield components. Overall, it was

observed that the application of naphthalene acetic acid 50 ppm at 30 and 50 DAS (T5) was found most effective for increasing the total chlorophyll, nitrate reductase, protein content in seed, total phenol content, number of pods per plants, pods weight per plants, number of seeds per plant, seed weight per plants, 100 seed weight, seed yield (g) per plant and seed yield q ha-1. Thus, it can be concluded that foliar application of NAA 50 ppm at two times favoured overall improvement in characters which were highly linked with yield. In northern India and Pakistan, nipping of the young shoots during vegetative growth and grazing of the young plants by sheep in Rajasthan causes an increase in auxiliary branches, which sometimes leads to increased yields. The effect of nipping in shorter growth duration condition at ICRISAT Center (peninsular India) was investigated. Nipping treatments tended to reduce yield, but the reduction was not statistically significant. The significant increased in grain yield in nipped chickpea plants might be due to higher number of branches per plant which produced more pods. Grain yield depends on yield contributing traits i.e. number of branches, number of pods per branch and 1000-grain weight. Although 1000-grain weight was non-significant but nipped plants had more number of branches and pods as compared to non-nipped plants. That is why the grain yield was higher in nipped plants as compared to non-nipped plants. Nipping followed by foliar applied NPK also helped the plant to improve number of branches and pods number.

Conclusion

Nipping in chickpea enhance yield attributes and yoield. Various result findings revelaed that nipping not only increased yield but also provide additional fooder and feed to the animal and human. Since chickpea crop is with minimal inputs, higher yield can be achieved if followed timely. Nipping practice should be combined with foliar nutrition for higher and sustained productivity. Nipping along with foliar application of NPK can be practiced in chickpea for higher profitability [15]. Though nipping has been done in chickpea, it has a vast scope in other crops also but with more refined and innovative techniques.

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