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Shubha S
ICAR-Krishi Vigyana Kendra, Hittinahalli Farm, Vijayapur, UAS, Dharwad, Karnataka, India

Vivek S Devaranavadagi
ICAR-Krishi Vigyana Kendra, Hittinahalli Farm, Vijayapur, UAS, Dharwad, Karnataka, India

Shivalingappa Hotkar
ICAR-Krishi Vigyana Kendra, Hittinahalli Farm, Vijayapur, UAS, Dharwad, Karnataka, India

Corresponding Author
Shubha S
ICAR-Krishi Vigyana Kendra, Hittinahalli Farm, Vijayapur, UAS, Dharwad, Karnataka, India

Effect of nipping on growth and yield of chickpea (*Cicer arientium* L.) under rainfed conditions of Karnataka

Shubha S, Vivek S Devaranavadagi and Shivalingappa Hotkar

Abstract
To achieve better crop production and yields in rainfed agriculture it is necessary to adopt nipping technology. A field demonstration was carried out at Hadagali village, Vijayapur district on Vertisols during *Kharif* 2019-20 and 2020-21 to study the effect of nipping on chickpea under rainfed conditions of Karnataka. Adopting nipping using solar operated tool and hand nipping increased the grain yield by 18.45, 7.72 per cent for 2019-20 and 25.0, 7.14 percent for 2020-21 respectively over farmer's practice. Significant reduction in plant height was seen in nipped plots than farmer's practice. The increase in grain yield indicates that nipping using solar operated tool could be effective treatment for chickpea in Vertisols. Higher gross and net returns with greater BC ratio was observed with nipping using solar operated tool followed by hand nipping technology.

Keywords: solar operated nipping tool, chickpea, hand nipping, rainfed areas, vertisols

Introduction
Pulses are the wonderful gift of nature. Unique ability of biological nitrogen fixation, deep root system, mobilization of insoluble soil nutrients and bringing changes in soils physical properties make them known as "soil fertility restorer". They fix and utilize atmospheric nitrogen and add up to the 30 kg N ha^{-1} to the soil. They have been valued as food, fodder and feed. Pulses are the primary source of nourishment and when combined with cereals, provide a nutritionally balanced low cost food for human being. India is the largest producer of pulses in the world with 25% share in the global production. Chickpea, pigeonpea, greengram, blackgram, lentil and field pea are important pulse crops contributing 39%, 21%, 11%, 10%, 7% and 5%, respectively to the total production of pulses in the country (Bhandana *et al.*, 2013) [3].

Chickpea is a main nutritive legume crop of rural and urban household of the poor in the developing world (Sharma *et al*., 2003). It is one of the major pulse crop in India and in many other countries. It is predominantly grown in cool, dry periods on receding soil moisture. It plays an important role in the diets of vegetarians around the world.

Chickpea is a key source of protein and it plays an important role in human nutrition for large population in the developing world. It is valued for its nutritive seeds with an less expensive and high quality source of protein (18-22%), carbohydrate (52-70%), fat (4-10%), crude fiber (1.37%), lysine (195-205 mg^{-1}), carotene (89-94 mg^{-1}), fiber (3%), minerals (calcium, magnesium, phosphorus, iron, zinc) and vitamins (Yadav *et al.*, 2007) [9].

Nipping of tendrils has been found to increase the number of branches, pod setting and better source-sink relation thereby enhancing the yield of plant. 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 favour 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, 2010) [2]. Nipping might have a significant role in developing well desired plant canopies and number of productive branches, at early stages, plant growth hormones particularly auxins are triggered to the lateral shoot buds which ultimately result in more branches. But uncontrolled nipping may create undesired results at the end because at latter stages of plant growth, the temperature rises and flowering and podding period starts. Excessive nipping at these stages cause reduction in the photosynthetic area and thus less

carbon assimilation takes place, which has negative effect on yield. (Khan, *et al*., 2006) [6].

In view of above consideration the present investigation entitled "Effect of nipping on growth and yield of Chickpea (*Cicer arientium* L.) under rainfed conditions of north Karnataka" was carried at Hadagali, Vijayapur district.

Methodology

A field demonstration was carried out during the rainy *(rabi*) season of 2019-20 and 2020-21 under northern dryzone of Karnataka at Hadagali village of Vijayapur district (situated at 16° 24' N latitude, 75° 63' E longitude and at an altitude of about 537 m above mean sea level). With the improved package of practice, assessment was carried out by taking 0.4 ha as a unit and covered a total area of 4.0 ha. The demonstration was carried out with 3 treatments (T_1=Farmers practice, T_2= Hand nipping and T_3= Nipping using solar operated tool) and 10 replications under randomized complete block design in the farmer's field. The land was brought to optimum tilth by ploughing twice with tractor drawn mould board plough. The soils of demonstration field for evaluating chickpea crop was deep clay soil with pH 7.2, available organic carbon 0.40 per cent, available N, P and K were 251.4, 37.4 and 478.6 kg ha^{-1}, respectively.

Sowing of chickpea was taken up in two consecutive years on 28th September 2019 and 1st October 2020, respectively. Weeds were controlled through one hoeing at 30 days after sowing and one manual weeding. The recommended rate of N (25 kg ha^{-1}) and P_2O_5 (50 kg ha^{-1}) was applied for chickpea at sowing. Nipping (cutting of growing shoots 2.5 cm top) at 35 DAS was undertaken using solar operated nipping tool which consist of solar panel (12 V, 10 W) built on top of the helmet and a DC motor (12 V, 5 W x 2). The remaining cultivation practices were followed as per the package of practice of UAS, Dharwad. In each year a pre-seasonal training and three trainings during the crop period were conducted to prepare the farmers on implementation of selected package of practices. The critical inputs were supplied to the farmers by procuring certified seeds of JG 11 from KVK, Vijayapur of Karnataka. Chickpea was harvested on 14th and 10th February 2019 and 2020, respectively. Five randomly selected plants from 10 sites in each treatment were harvested. Standard procedures were used to measure the yield attributes and yield parameters of chickpea. Variables were analyzed and least significance difference (LSD) test was carried out for analyzed mean square errors using Web Based Agricultural Statistics software Package (WASP 2.0). Significance and non-significance difference between treatments was derived through procedure provides for a single LSD value (Gomez and Gomez, 1984) [5]. Correlation studies among the yield components of chickpea was done using XLSTAT package.

Results and Discussion

A. Effect on plant height

The data pertaining to mean plant height as influenced by different treatments are presented in Table.1. It revealed that the plant height of chickpea increased with the advancement of crop age. On an average marked improvement in plant height was observed up to harvest. At harvest, the plant attained average height of 44.80 cm. The plant height was significantly higher with control *i.e*., plants without nipping compared to the nipping treatments. Nipping has direct impact on growth and branching of chickpea. Nipping using solar operated tool at 35 DAS followed by hand nipping produced significantly higher number of branches and reduced plant height. Number of branches per plant was significantly higher in plants nipped using solar operated tool at 35 days after sowing followed by hand nipping, while there is manual pinching it leads to increase in the lateral branches underneath it by reducing the apical dominance, leading to increase in the no. of branches at the time of nipping than control. The plant height was increased continuously up to harvest in farmer's practice.

Table 1: Mean plant height (cm) of chickpea as influenced periodically by different treatments

Treatments	Days after sowing						At harvest	
	30 DAS		60 DAS		90 DAS			
	2019	2020	2019	2020	2019	2020	2019	2020
Farmers practice (T_1)	13.20	13.50	34.50	34.85	42.50	41.55	44.80	44.65
Hand nipping (T_2)	12.25	13.00	32.10	31.65	39.40	39.00	41.35	40.20
Nipping using solar operated tool (T_3)	11.50	12.05	30.25	29.00	37.25	37.10	38.80	39.10
SEm ±	0.58	0.52	1.43	1.96	1.76	1.49	2.02	1.86
CD (0.05)	1.74	1.57	4.28	5.86	5.25	4.47	6.04	5.56

Data presented in Table.1 revealed that plant height was significantly influenced due to different nippings. Farmer's practice recorded significantly maximum plant height (44.80 cm and 44.65 cm) as compared with nipping using solar operated tool (38.80 cm and 39.10) and hand nipping (41.35 cm and 40.20) for 2019 and 2020 respectively. Farmer's practice significantly increased the plant height by 14.20 and 11.10 per cent over the nipping using solar operated tool and hand nipping treatments. The data revealed that the treatment with no nipping recorded significantly higher plant height as compared with the other treatments at 30 DAS, 60 DAS, 90 DAS and at harvest. The reduction in the plant height of nipped plants could be credited to the removal of auxin at the apical meristem which probably reduced apical dominance of auxin and plants began to produce lateral branches instead of going to height. Similar results were obtained by Gnyandev *et al*., (2019) [4] that the terminal shoot tip of chickpea plant was nipped at 30 DAS to restrict growth and enhance horizontal growth and to derive such added benefits of nipping. Between nipping and no nipping treatments, no nipped plants recorded significantly higher plant height at 60 DAS and at harvest (37.78 and 44.23 cm, respectively) compared to nipped plant. While, nipped plants recorded significantly more number of pod productive branches (22.44 and 25.12) at 60 DAS and at harvest respectively compared to non-nipped plants (19.81 and 22.43).

B. Effect on number of branches

The vegetative and reproductive development of the crop culminating into economic yield was the terminal outcome of growth, which was affected by continuously interaction occuring between environment and plant physiological

process. The maximum number of branches per plant was observed in nipping using solar operated tool treatment which is on-par with hand nipping treatment (Table.2). Nipping using solar operated tool treatment significantly increased the number of branches per plant by 14.19 and 29.41 per cent over the farmer's practice treatment for 2019 and 2020 respectively. These results are in good agreement with Aziz (2000) [1] reported in chickpea that among pinching levels (30, 40, 60 and 75 days after emergence), pinching at 30 days to emergence gave maximum number of branches plant $^{-1}$ but it was statistically similar to pinching at 45 days after emergence. Maximum number of pods plant $^{-1}$ was found with pinching at 30 days with maximum yield (2394 kg ha^{-1}) than other treatments and control (2018 kg ha^{-1}).

Table 2: Mean number of branches plant^{-1}of chickpea as influenced periodically by different treatments

Treatments	Days after sowing						At harvest	
	30 DAS		60 DAS		90 DAS			
	2019	2020	2019	2020	2019	2020	2019	2020
Farmers practice (T_1)	2.90	2.70	5.80	5.65	8.10	7.65	8.10	7.65
Hand nipping (T_2)	3.02	2.86	6.20	6.15	8.50	8.35	8.80	9.35
Nipping using solar operated tool (T_3)	3.05	3.45	6.95	6.50	9.25	9.90	9.25	9.90
SEm ±	0.06	0.26	0.39	0.31	0.26	0.54	0.16	0.76
CD (0.05)	0.17	0.79	1.17	0.92	0.79	1.63	0.46	2.27

C. Effect on yield and economics

It is evident from the data presented in (Table. 3) that among the different nipping treatments the highest yield was registered in nipping using solar operated tool treatment 13.80 q/ha (2019) and 14.00 q/ha (2020) which is on-par with hand nipping treatment 12.55 q/ha (2019) and 12.00 q/ha (2020) respectively (Table.3). Hand nipping increased the yield by 7.74 per cent (2019) and 7.15 per cent (2020) over the farmer's practice treatment. Apical bud pinching leads to production of branches thus increased canopy size and photosynthetic activity and accumulation of more photosynthesis resulting in increased seed size and yield (Lakshmi *et al.*, 2015, Vasudevan *et al.*, 2008) [7, 8].

We found higher gross returns of Rs. 79450 ha^{-1} (2019) and Rs. 77525 ha^{-1} (2020) with more net returns of Rs. 58390 ha^{-1} (2019) and Rs. 56565 ha^{-1} (2020) was observed in nipping using solar operated tool treatment which is on-par with hand nipping treatment. Nipping using solar operated tool increased the gross returns, net returns and BC ratio by 27.22, 33.76 and 25.00 per cent for 2019 and 30.51, 36.30 and 43.12 per cent for 2020 over farmer's practice respectively (Table.3).

Table 3: Yield and economics of chickpea as influenced periodically by different treatments

Treatments	Yield (Q ha^{-1})		Gross return (Rs ha^{-1})		Net return (Rs ha^{-1})		B:C ratio	
	2019	2020	2019	2020	2019	2020	2019	2020
Farmers practice (T_1)	11.65	11.20	62450	59400	43650	41500	2.32	2.11
Hand nipping (T_2)	12.55	12.00	74300	75680	55780	56115	2.75	2.50
Nipping using solar operated tool (T_3)	13.80	14.00	79450	77525	58390	56565	2.90	3.02
SEm ±	0.74	0.94	5673	6233	5280	5080	0.21	0.31
CD (0.05)	2.21	2.82	17012	18710	15820	15242	0.62	0.92

Conclusion

On the basis of results obtained during the course of present field demonstration it is concluded that, under rainfed conditions of northern Karnataka nipping was found significant in enhancing the productivity of chickpea. Nipping using solar operated tool at 35 DAS was found to be profitable. Nipping using solar operated tool gave best results as compared to hand nipping. As nipping plays significant role in nodulation and branching, nipped demonstration plots under chickpea gave superior results over farmer's practice.

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