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Effect of Nipping and Varieties on Growth, Yield Attributes and Yield of Chickpea

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Abstract

Field experiment was conducted to study the effect of nipping practices and varieties on yield attributes and yield of chickpea during rabi 2020-21 at JNKVV, College of Agriculture, Tikamgarh (Madhya Pradesh). The experiment was conducted in split-plot design with three replications and comprised of three nipping practices viz., N1; no nipping, N2: nipping at 35 DAS and N3: nipping at 45 DAS as main plot treatments and four cultivars viz., V1: JG-12, V2: JG-36, V3: RVG 201 and V4: RVG 202 as sub-plot treatments. Results revealed that nipping of apical portion of chickpea at 45 DAS resulted into significantly more number of secondary branches (plant^{-1}), higher LAI and total dry matter accumulation(plant^{-1}) which reflected into more numbers of pods (103 plant^{-1}) and 100-seed weight (19.3 g) as compared to nipping at 35 DAS (89.6 plant^{-1} and 19.2 g, respectively) and the lowest yield attributes was observed with no nipping practices (82.4 plant^{-1} and 18.4 g, respectively). The significantly higher seed yield (2567 kg ha^{-1}), straw yield (4037 kg ha^{-1}), biological yield (6604 kg ha^{-1}) were also recorded with nipping practices at 45 DAS followed by nipping at 35 DAS (2331 kg ha^{-1}, 3581 kgha^{-1} and 5912, respectively) and the lowest (1945 kg ha^{-1}, 3377 kg ha^{-1} and 5322 kg ha^{-1}, respectively) with no nipping practices. Nipping in chickpea at 45 DAS increased the grain yield (kg ha^{-1}) by 32.0% and 10.1% over no nipping and nipping at 35 DAS, respectively. Among varieties, cv. JG 12 produced significantly more number of pods (102 plant^{-1}) followed by cvs. RVG 201 (94.9 plant^{-1}), JG 36 (89.9 plant^{-1}) and the lowest in cv. RVG 202 (80.0 plant^{-1}). The significantly higher seed yield (2506 kg ha^{-1}), straw yield (3862 kg ha^{-1}) and biological yield (6368 kg ha^{-1}) were also recorded in cv. JG 12 followed by cv. RVG 201 (2315 kg ha^{-1}, 3738 kg ha^{-1} and 6053, respectively), JG 36 (2217 kg ha^{-1}, 3557 kg ha^{-1} and 5774, respectively) and significantly the lowest in cv. RVG 202 (2086 kg ha^{-1}, 3502 kg ha^{-1} and 5588 kg ha^{-1}, respectively). Variety JG-12 increased the grain yield (kg ha^{-1}) by 8.2 %, 13.0% and 20.1% over RVG-201, JG-36 and RVG-202, respectively. The combination of nipping at 45 DAS with cv. JG-12 increased the grain yield (kg ha^{-1}) by 4.5% to 56.6% over rest of the combinations of treatments.

Key words: chickpea, growth, nipping, yield, yield attributes, varieties

Introduction

Chickpea (*Cicer arietinum* L.) is the second-most main pulse crop after pigeon pea in the humankind for diet and other use. India is the principle chickpea producing country in the world with a total production of 10.13 million tonnes and cultivated area of 9.44 million hectare with an average yield of 1073 kg ha^{-1}. There are many factors responsible for the low yield of chickpea *viz*., utilization of conventional or low yielding varieties and adoption of poor management practices. Nevertheless, it is imperative to increase productivity in different agro ecological zones by manipulating various agronomic practices. Nipping in chickpea is one of the important parameter for the enhancement of yield and yield contributing parameters. Nipping means the removal of top portion (apical meristem) of a plant to induce branching on the plant at the remaining nodes. Foliage nipping at early stages of crop could increase number of branches while restricting profuse vegetative growth thereby promoting crop yield[18]. Nipping at various stages tended to enhance

number of branches and number of pods that in turn boost chickpea yield[1]. Nipping at 45 DAS in chickpea increased yield as well as controlled disease severity[5]. Nipping practice in the research area has two fold advantages. On the one hand, nipping at prescribed growth stages could improve yield of the crop while on the opposite hand during time, the chickpea within the field is typically a shortage of fodder and poor farmers couldn't afford to purchase forage at distant locations, so chickpea may provide them a chance to fetch green fodder for his/her livestock.

The crop growth and yield of chickpea varieties under nipping at various stages help to pick the foremost promising variety in term of yield potential. Grain, straw and biological yield of chickpea crop were significantly influenced by the different varieties and nipping. The yield diversity concerning different varieties may also be caused by variation in pod bearing ability and therefore the number of seeds per pod[6]. There is highly significant difference in the interaction of chickpea varieties with nipping which indicates that different varieties of chickpea reacted in a different way to nipping[10]. Keeping these facts in view, an experiment was conducted to study the effect of nipping on yield attributes and yield of chickpea varieties.

Materials and Methods

Field experiment was conducted at Agronomy Research Area, J.N.K.V.V., College of Agriculture, Tikamgarh, Madhya Pradesh (24° 43' N latitude and 78° 49' E longitude at an altitude of 358m above mean sea level) during *rabi* 2020-21. The experimental site is of sub-tropical climate characterized by hot dry summers and cool dry winter lies in the Bundelkhand Zone (Agro-climatic Zone-VIII). The soil of experimental field was medium to deep black and clayey loam in texture having pH 7.1, EC 0.12 dS m^{-1}, organic carbon 0.5%, available N 265 kg ha^{-1}, available P_2O_5 26 kg ha^{-1} and available K_2O 260 kg ha^{-1}. The average annual rainfall of this region is about 1000 mm, which is mostly received between June to September and a little rainfall of 90 mm is also obtained during October to May. The average temperature ranges between 4.5℃ to 45℃. The experiment was conducted in split-plot design with three replications and comprised of three nipping practices viz., N1; no nipping, N2: nipping at 35 DAS and N3: nipping at 45 DAS as main plot treatments and four cultivars *viz*., V1: JG-12, V2: JG-36, V3: RVG 201 and V4: RVG 202 as sub-plot treatments. The full recommended doses of nitrogen (20 Kg N ha^{-1}), phosphorus (40 Kg P_2O_5 ha^{-1}) and potassium (20 kg K_2O ha^{-1}) were applied at sowing. The chickpea crop was sown in lines 30 cm apart using a seed rate of 80 kg ha^{-1}. Nipping was done at 35 DAS and 45 DAS in the respective treatments. All other agronomic and plant protection measures were applied as per recommendations. Yield attributes were recorded from the five plants sample collected at the time of harvest. The crop harvested from net plot area was threshed after 4-5 days of sun drying and the seed yield of net plot was then converted into kg ha^{-1}. Before threshing of the crop harvested from net plot, the sun dried whole plant samples were weighed and then converted into kg ha^{-1} to obtain biological yield. Straw yield is obtained by subtracting seed yield (kg ha^{-1}) from biological yield (kg ha^{-1}). The results were analyzed statistically to draw suitable inference as per standard ANOVA technique[8].

Results and discussion

Effect of nipping practices on growth attributes

Data pertaining to growth parameters like plant height (cm), number of secondary branches plant^{-1}, leaf area index and total dry matter accumulation (g plant^{-1}) as influenced by nipping is given in Table 1.

Table 1 Effect of nipping practices and varieties on growth of chickpea

Treatments	Plant height (cm)	Number primary branches plant^{-1}	Number secondary branches plant^{-1}	Total dry matter accumulation (g plant^{-1})	Leaf area index at 100 DAS
Nipping					
N1 : No nipping	51.5	12.4	19.3	34.6	5.19
N2 : Nipping at 35 DAS	25.9	10.6	21.4	44.9	5.44
N3 : Nipping at 45 DAS	36.7	11.3	22.2	48.6	6.27
S.Em ±	0.37	0.17	0.48	0.17	0.03
CD (P=0.05)	1.47	0.68	1.88	0.68	0.10
Varieties					
V1 : JG 12	40.7	12.5	23.2	44.9	6.03
V2 : JG 36	37.3	11.1	20.1	42.0	5.53
V3 : RVG 201	38.4	11.7	21.8	43.9	5.76
V4: RVG 202	35.8	10.6	18.7	40.0	5.21
S.Em ±	0.56	0.16	0.20	0.33	0.05
CD (P=0.05)	1.66	0.48	0.59	0.98	0.15
Interaction (nipping x variety)					
N1V1	53.6	14.4	22.4	36.6	5.38
N1V2	50.7	11.7	18.7	33.7	5.19
N1V3	51.4	12.6	19.4	35.6	5.24
N1V4	50.4	11.1	16.8	32.7	4.97
N2V1	27.0	11.2	23.4	47.6	5.79
N2V2	25.7	10.5	20.5	45.1	5.20
N2V3	26.2	10.9	22.4	46.6	5.53
N2V4	24.8	9.97	19.3	40.3	5.24
N3V1	41.4	12.0	23.7	50.4	6.92
N3V2	35.4	11.2	21.1	47.3	6.21
N3V3	37.7	11.5	23.7	49.4	6.52
N3V4	32.2	10.7	20.1	47.1	5.42
S.Em ±	0.97	0.28	0.35	0.57	0.09
CD (P=0.05)	2.88	0.84	1.03	1.70	0.25

The plant height (51.5cm) and number of primary branches plant^{-1} (12.4) were significantly higher with no nipping followed by nipping at 45 DAS (36.7cm and 11.3, respectively) and significantly lower in nipping at 35 DAS (25.9cm and 10.6, respectively). The higher plant height noticed with no nipping was mainly due to the reason that nipping was not done and such plants grew to their original height without reduction unlike nipping at 45 DAS and nipping at 35 DAS. The increasing of plant height in no nipping might also be due to continuous supply of auxins to apical portion which leads apical dominance and inhibits secondary branches and thus plant continued its height[7]. Similarly, the more number of primary branches plant^{-1} with no nipping was due to taller plants and apical dominance, whereas minimum number of primary branches plant^{-1} were investigated with nipping at 35 DAS followed by nipping at 45 DAS due to lower plant height[3]. The number of secondary branches plant^{-1} and LAI were significantly highest with nipping at 45 DAS (22.2 and 6.27, respectively) followed by nipping at 35 DAS (21.4 and 5.44, respectively), whereas lowest in no nipping (19.3 and 5.19, respectively). This might be caused by nipping of apical portion which resulted in production of more secondary branches and leaf area and cessation of vertical growth on account of effective translocation of growth regulators particularly auxins being diverted to the secondary shoot buds which in normal conditions remain dormant[9]. In no nipping situation, the auxiliary buds development is inhibited by IAA produced in the apical portion. This is the main reason for lowest number of secondary branches plant^{-1} with no nipping[3].

Total dry matter accumulation (g plant^{-1}) was increased significantly due to the nipping at 35 DAS (44.9 g plant^{-1}) and 45 DAS (48.6 g plant^{-1}) compared to no nipping (34.6 g plant^{-1}). It might be due to better utilization of available resources with nipping which resulted in more photosynthesis and hence more dry matter was produced. The accumulation of dry matter plant^{-1} depends on leaf area and photosynthetic rate of plant. The positive increase in number of secondary branches palnt^{-1} might have offered higher chance for the increased production of more leaf area reflected into more photosynthesis by leaves which subsequently, resulted in higher dry matter accumulation[6].

Effect of varieties on growth attributes

Results in Table 1 reveals that chickpea var. JG 12 recorded significantly the tallest plant (40.7cm), more number of primary branches plant^{-1} (12.5), more number of secondary branches plant^{-1} (23.2), higher leaf area index (6.03) and higher total dry matter accumulation (44.9 g plant^{-1}), whereas the significantly the smallest plant (35.8cm), minimum number of primary branches plant^{-1} (10.6), minimum number of secondary branches plant^{-1} (18.7), minimum leaf area index (5.21) and minimum total dry matter accumulation (40.0 g plant^{-1}) were observed in var. RVG 202. The greatest plant height in var. JG 12 may be mainly due to efficient accumulation of photosynthates in the vegetative plant parts. The numbers of primary and secondary branches plant^{-1} were also higher in JG-12 as compared to other varieties. Such varietal differences in number of branches might be due to higher growth and genetic character of variety in chickpea[15,7]. The significantly highest total dry matter accumulation (g plant^{-1}) in var. JG-12 might be due to variation in overall growth and development of

individual variety, which indicates more photosynthetic activity. Further results showed that variety JG-12 produced higher leaf area index was mainly caused due to higher number of secondary branches plant^{-1}[6].

Interaction effect on yield attributes and yield

Interaction between nipping and varieties significantly influenced all growth parameters of chickpea (Table 1). The interaction of no nipping with variety JG-12 registered significantly higher plant height and number of primary branches plant^{-1} over other interactions. The higher plant height and number of primary branches plant^{-1} noticed in the interaction of no nipping treatment with variety JG-12 was mainly due to apical dominance due to auxins so the plant grew to their original height unlike nipped plant. The interactional effect of nipping at 45 DAS with variety JG-12 was found superior in number of secondary branches plant^{-1}, LAI, dry matter accumulation (g plant^{-1}) and CGR of chickpea crop over all other interactions. This might be due to nipping effect of apical bud on chickpea variety which resulted in production of more secondary branches, higher LAI, DMA, CGR and cessation of vertical growth on account of effective translocation of growth regulators particularly auxins[11,10].

Effect of nipping practices on yield attributes and yield

Data pertaining to yield attributes and seed yield as affected by nipping practices has been given in Table 2 and Table 3, respectively.

Table 2 Effect of nipping practices and varieties on yield attributes of chickpea

Treatments	Number pods plant^{-1}	Number seeds pod^{-1}	Seed index (g)
Nipping			
N1 : No nipping	82.4	1.23	18.4
N2 : Nipping at 35 DAS	89.6	1.27	19.2
N3 : Nipping at 45 DAS	103	1.30	19.3
S.Em ±	0.37	0.03	0.13
CD (P=0.05)	1.44	NS	0.52
Varieties			
V1 : JG 12	102	1.31	16.6
V2 : JG 36	89.9	1.25	16.9
V3 : RVG 201	94.9	1.27	21.7
V4: RVG 202	80.0	1.24	20. 7
S.Em ±	0.41	0.05	0.32
CD (P=0.05)	1.23	NS	0.95
Interaction (nipping x variety)			
N1V1	93.2	1.28	16.8
N1V2	78.6	1.34	16.7
N1V3	85.4	1.17	21.5
N1V4	72.5	1.14	18.6
N2V1	100	1.33	16.5

N2V2	90.7	1.20	16.5
N2V3	93.5	1.19	21.4
N2V4	74.1	1.35	22.5
N3V1	112	1.31	16.4
N3V2	101	1.22	17.5
N3V3	106	1.45	22.3
N3V4	93.3	1.22	20.9
S.Em ±	0.72	0.09	0.55
CD (P=0.05)	2.13	NS	1.65

Table 3 Effect of nipping practices and varieties on yield of chickpea

Treatments	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
Nipping				
N1 : No nipping	1945	3377	5322	36.5
N2 : Nipping at 35 DAS	2331	3581	5912	39.4
N3 : Nipping at 45 DAS	2567	4037	6604	38.9
S.Em ±	18.4	52.8	53.8	0.41
CD (P=0.05)	72.3	207.5	211.2	1.62
Varieties				
V1 : JG 12	2506	3862	6368	39.3
V2 : JG 36	2217	3557	5774	38.3
V3 : RVG 201	2315	3738	6053	38.2
V4: RVG 202	2086	3502	5588	37.4
S.Em ±	28.4	58.0	69.1	0.42
CD (P=0.05)	84.5	172.2	205.3	1.23
Interaction (nipping x variety)				
N1V1	2064	3386	5450	37.9
N1V2	1931	3367	5297	36.5
N1V3	2003	3397	5400	37.1
N1V4	1781	3358	5139	34.7
N2V1	2667	3861	6528	40.8
N2V2	2167	3522	5689	38.1
N2V3	2367	3767	6133	38.6
N2V4	2125	3172	5297	40. 2
N3V1	2789	4339	7128	39.1
N3V2	2553	3783	6336	40.3
N3V3	2575	4050	6625	38.9
N3V4	2353	3975	6328	37.2

S.Em ±	49.2	100.4	119.7	0.72
CD (P=0.05)	146.3	298.2	355.6	2.14

Results revealed that nipping practices in chickpea crop significantly influenced the yield attributing characters. Nipping of apical portion of chickpea at 45 DAS resulted into significantly more numbers of pods (103 plant^{-1}) and 100-seed weight (19.3 g) as compared to nipping at 35 DAS (89.6 plant^{-1} and 19.2 g, respectively) and the lowest yield attributes was observed with no nipping practices (82.4 plant^{-1} and 18.4 g, respectively). However, nipping practices at 35 and 45 DAS failed to significantly influence the number of seeds pod^{-1}.

The increase in yield attributing parameters noticed with nipping practice was mainly due to accumulation of more photosynthates which were utilized for production of more number of productive secondary branches and more number of pods plant^{-1} in chickpea. Similar results were also obtained by other workers[11,1] in chickpea. The nipping at 45 DAS might have efficiently altered the crop architecture by activating the dormant lateral secondary branches which ultimately increased the number to pods plant^{-1} which leads to greater chance for development of source and sink relationship in chickpea and thereby would have facilitated the significant increase in the yield attributes of the chickpea. This has also been documented by other worker[12] in sesame. The significant improvement in the number of pods plant^{-1} in nipping at 45 DAS and 35 DAS might be due to initiation of higher number of branches plant^{-1} which probably originated more flower buds that resulted in more pods. The results were in accordance with the findings of other workers[3,9]. The increased yield components might be attributed to activation of lateral dormant buds by arresting the terminal growth through nipping which might have facilitated the significant increase in the yield attributes. Similar findings were also reported by other worker[20] in pigeon pea. The increase in yield attributes with nipping at 45 DAS and 35 DAS might also be due to enhanced branching and dispersion of carbohydrates towards auxiliary vegetative buds below nipped portion which might have helped in production of more number of pods plant^{-1}and grain yield compared to no nipping[19].

The significantly higher seed yield (2567 kg ha^{-1}), straw yield (4037 kg ha^{-1}), biological yield (6604 kg ha^{-1}) were recorded with nipping practices at 45 DAS followed by nipping at 35 DAS (2331 kg ha^{-1}, 3581 kgha^{-1} and 5912, respectively) and the lowest (1945 kg ha^{-1}, 3377 kg ha^{-1} and 5322 kg ha^{-1}, respectively) with no nipping practices. The higher yield under nipping treatments might be because of the development of auxiliary buds which is inhibited by indole acetic acid (IAA) produced in the apical portion. When the source of auxins is removed by nipping, the lateral branching gets activated which resulted in increased number of pods plant^{-1} (Table 2) thereby increased seed yield. This was also explained by other workers in sesame[4,12]. Increase in yield with nipping as compared with no nipping clearly indicates that the energy which was previously used by plant to become taller was diverted towards grain formation. Grain yield depends on yield attributes *i.e.*, number of branches (data not given) and number of pods plant^{-1} that is why grain yield was higher with nipping at 45 DAS followed by nipping at 35 DAS as

compared to no nipping. This was similar to the findings of other worker[9].

Effect of varieties on yield attributes and yield

Varieties were also significantly influenced the yield attributes of chickpea (Table 2). Among varieties, *cv*. JG 12 produced significantly more number of pods (102 plant^{-1}) followed by *cvs*. RVG 201 (94.9 plant^{-1}), JG 36 (89.9 plant^{-1}) and the lowest in *cv*. RVG 202 (80.0 plant^{-1}). However, seed index (100 seeds weight) was observed in cv. RVG 201 (21.7g) followed by cvs. RVG 202 (20.7g), JG 36 (16.9g) and the significantly the lowest in cv. JG 12 (16.6g). Similarly, number of seeds pod^{-1} did also not differ significantly among varieties. The differences in yield attributes observed among chickpea varieties might be due to their differences in growth habit and genetic yielding ability. Similar varietal difference in chickpea with respect to yield attributes was also reported by other workers[2,7,15,16] in chickpea and cowpea.

The significantly higher seed yield (2506 kg ha^{-1}), straw yield (3862 kg ha^{-1}) and biological yield (6368 kg ha^{-1}) were recorded in *cv*. JG 12 followed by *cv*. RVG 201 (2315 kg ha^{-1}, 3738 kg ha^{-1} and 6053, respectively), JG 36 (2217 kg ha^{-1}, 3557 kg ha^{-1} and 5774, respectively) and significantly the lowest in *cv*. RVG 202 (2086 kg ha^{-1}, 3502 kg ha^{-1} and 5588 kg ha^{-1}, respectively). This yield variation in respect of various varieties might be due to variation in pod bearing ability and vigorous growth. The higher yield could be attributed due to greater growth parameters *viz*., plant height, number of primary and secondary branches more LAI (data not given) and cumulative effect of yield attributes (Table 2). The variety RVG-202 is a poor yielder because of its poor growth, yield attributes and canopy makeup. Similar results were also reported by other workers in chickpea and in pigeon pea[6,20].

Interaction effect on yield attributes and yield

Interaction between nipping and varieties significantly influenced yield attributes of chickpea. The interactional effect of nipping at 45 DAS with variety JG-12 recorded higher number of pods plant^{-1} (112) over other treatment combinations. However, number of seeds pod^{-1} did not differ significantly due to various interaction effects. Significantly, highest seed index (22.5g) was registered in the interaction of nipping at 35 DAS with variety RVG- 202 over other interactions. The increase in yield attributes noticed in the interaction of nipping with varieties was mainly due to accumulation of more photosynthates which were utilized for production of more number of productive secondary branches and more number of pods plant^{-1} in chickpea. Similar results were also obtained by other worker in chickpea[11] and in pigeon pea [10,14].

Interaction between nipping and varieties was also significantly influenced the grain yield, straw yield, biological yield. The interactional effect of nipping at 45 DAS with variety JG-12 recorded significantly highest grain yield (2789 kgha^{-1}), straw yield (4339 kgha^{-1}) and biological yield (7128 kgha^{-1}) over other treatment combinations. Increase in yield of varieties with nipping as compared to no nipping that the energy which was previously used by varieties to become taller was diverted towards grain formation due to nipping. Similar results were revealed by other workers[19,6].

Conclusion

The results concluded that nipping at 45 DAS recorded significantly more number of secondary branches (plant^{-1}), higher LAI and total dry matter accumulation(plant^{-1}) which reflected into higher yield attributes and yields over nipping at 35 DAS and no nipping in chickpea varieties. Nipping in chickpea at 45 DAS increased the grain yield (kg ha^{-1}) by 32.0% and 10.1% over no nipping and nipping at 35 DAS, respectively. Among chickpea varieties, JG-12 was found significantly superior over other varieties in terms of yield attributes and seed yield. Variety JG-12 increased the grain yield (kg ha^{-1}) by 8.2 %, 13.0% and 20.1% over RVG-201, JG-36 and RVG-202, respectively. The interactional effect between nipping at 45 DAS with cv. JG-12 was found superior over rest of the combination for yield attributes and yield. The combination of nipping at 45 DAS with *cv*. JG-12 increased the grain yield (kg ha^{-1}) by 4.5% to 56.6% over rest of the combinations of treatments. On the basis of results of current study, it may be recommended that the farmer can get maximum return by the adoption of nipping at 45 DAS. Among the varieties, cv. JG-12 is very suitable variety to get higher return. The nipping practices at 45 DAS with *cv*. JG-12 may be suitable to increase farmer's income.

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