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Yield and yield attributing character of rainfed horse gram (*Macrotyloma uniflorum* Lam.) as influenced by nipping and spacing in Chhattisgarh

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Abstract
A field trial was conducted at Instructional cum Research Farm, DKS College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya, Raipur, (C.G.) to investigate influence of nipping and spacing on growth and yield of rainfed horse gram. The experiment used a factorial randomized block design with three replications and 10 treatments combinations with two factors. The factor one with two levels of spacing (C1- Broadcasting and C2- 30×10 cm) and second factor with five levels of nipping (N1- no nipping, N2- manual nipping at 25 DAS, N3- manual nipping at 25 and 40 DAS, N4- mepiquat chloride at 250 ppm and N5- chlormequat chloride at 250 ppm). Nipping and growth retardants spray was done at 40 DAS, Growth and yield parameters such as number of branches plant-1, number of pods plant^{-1}, number of seeds pod-1, 1000 seed weight (g) and harvest index were recorded. Spacing of 30×10 cm recorded significantly higher yield (795 kg ha^{-1}), whereas more number of branches (10.59), higher number of pods plant-1 (44.95) were recorded with a broadcasting. Spraying of mepiquat chloride at 250 ppm recorded significantly higher yield (867 kg h^{-1}), more number of branches (11.19) and higher number of pods plant^{-1} (55.60), followed by spraying of chlormequat chloride at 250 ppm spray with a yield of 835 kg ha^{-1}. Among the treatment combinations, spacing of 30 × 10 cm with mepiquat chloride-250 ppm.

Keywords: Horse gram, nipping, spacing, mepiquat chloride at 250 ppm and chlormequat at 250 ppm

Introduction
Pulse crops, known as "grain legumes," are the most important food crops after cereals. Legumes are sometimes referred to as "poor man's meat" and "rich man's vegetables." The pulses in India are cultivated in semi-arid regions.

Horse gram (*Macrotyloma uniflorum* Lam.) is an underutilized food legume (Marimuthu. 2013) [11], well popularized for its hardiness and wider adaptability to adverse climatic conditions and poor soils which are unsuitable for other crops (Suthar *et al*., 2017) [15]. Horse gram is an important cover crop and it can fix atmospheric nitrogen through root nodules

The chromosome number 2n=2x=20 indicates that it is a genuine diploid. India is the only country where horse gram is grown for human consumption on a large scale. It's a versatile crop that may be grown anywhere at the sea level to 1800 meters above it. It's a drought-resistant crop that thrives in low-water conditions. Global efforts to protect the horse gram germplasm are poor due to the crop's lack of attention. It can be utilized as a fodder and green manure crop in many tropical zones. In several sections of India, especially in the south. It's traditionally been used as a cover crop and it's thought to work well with cereals and millets like pearl millet and finger millet. (Krishna, 2010 and Kumar, 2006) [8, 10].

The whole seed of the horse gram, while being categorized as a pulse, is utilized as a bovine feed, containing around 12 percent protein in fodder. It is well-known for both its medicinal and nutritional benefits. It is consumed as a whole seed and as sprouts in India. Horse gram has a lengthy medical history, with various parts of the plant used to treat asthma, bronchitis, urinary diseases, cholesterol lowering and kidney stones (Ghani, 2003) [3]. Horse gram water is advised for the treatment of jaundice in Andhra Pradesh. Horse gram seed has a carbohydrate composition of 57.0 percent, a protein content of 22.0 percent and a fat content of 2.5 percent (Sudha *et al*., 1995) [13].

In India pulse crops cover 28.34 million hectares in India, with an output of 23.15 million tonnes. Horse gram is a popular pulse crop farmed primarily in Karnataka, Odisha, Chhattisgarh, Andhra Pradesh, Tamil Nadu and Maharashtra are some of the states in India.

In Bihar, the horse gram yield is 980 kg ha^{-1}, which is higher than the national average (Anonymous, 2020) [1, 2]. Horse gram is grown in Chhattisgarh on area of 32000 ha, producing 9300 tonnes year^{-1} with an average yield of 290 kg ha-1 (Anonymous, 2020) [1, 2]. Numerous management techniques, including as nipping and spacing, can change the production of horse gram.

Crop geometry plays a significant role on the growth and development of crop as wider spacing reduces the competition between the plants (Kithan and Singh, 2017) [7].

Nipping is a technique for promoting lateral growth by removing the apical bud. The activation of lateral buds promotes lateral development and the production of lateral branches once apical dominance has been removed from the plant (Patel *et al*., 2016) [12]. Stated that nipping before or at 30 DAS significantly enhanced the productivity in pea as it plays an important role in nodulation.

Materials and methods

A field trial was conducted during mid *kharif* season of 2021 at Instructional cum Research Farm, DKS College of Agriculture and Research Station, Bhatapara. (CG). The experiment consisted of 10 treatments combinations comprising of two spacing (C1- Broadcasting and C2- 30 × 10 cm) five levels of nipping (N1- no nipping, N2- manual nipping at 25 DAS, N3- manual nipping at 25 and 40 DAS, N4 - mepiquat chloride at 250 ppm and N5- chlormequat chloride at 250 ppm. Growth retardants spray was done at 40 DAS. The experiment was laid out in Factorial Randomized block design with three replications. Nitrogen (20 kg ha^{-1}), Phosphorous (50 kg ha^{-1}) and potassium (20 kg ha^{-1}) was applied as basal. One additional irrigation was administered during the crop season at the time of flowering, and intercultural activities were carried out at 25 DAS and 45 DAS to eradicate weeds. The crop was harvested in the last week of November after reaching maturity at 105 days. Following harvest, statistical analysis was performed on the data on yield-attributing traits including number of pods plant^{-1}, seeds pod^{-1}, 1000 seed weight, seed yield, and straw yield, and crucial differences were estimated.

Result and Discussion

Number of branches

As shown in table 1. Results indicated that the number of branches plant-1 significantly affected by different spacings at 60 DAS and 90 DAS where as it was unaffected at 30 DAS. Number of branches were more in case of the treatment combination of mepiquat chloride at 250 ppm + 30 × 10 cm spacing (11.19). The reason for increased number of branches might be because of the fact that the application of mepiquat chloride at 250 ppm acts more or less as an anti-auxin. As auxin is responsible for the apical dominance, more number of branches will be produced as the apical dominance is removed which was explained by Sudhakar and Rani (2018) [14]. The maximum number of branches were observed at a spacing of 30 ×10 cm (10.59) significantly more than that of broadcasting (8.02). As the spacing is wider in case of 30 ×10 cm, the competition for individual plant is less which leads to more number of branches

Yield attributes

Yield attributes as mentioned in the Table 1. Yield attributes the foliar spray of mepiquat chloride at 250 ppm was shown to higher pods plant-1 (55.60), seeds pod-1 (5.71), 1000 seeds weight (33.26), seed yield (867 kg ha^{-1}), straw yield (2968 kg ha^{-1}) and harvest index (21.71) in the case of nipping. An increase in lateral branches results in an increase of pods plant^{-1}, which in turn results in a rise in yield and yield attributes. According to (Jaidka *et al.*, 2018) [4] and (Khan *et al.*, 2018) [6].

Whereas among the treatments combinations, the seed yield (946 kg ha-1), straw yield (3049 kg ha-1) and harvest index (0.237) was found to be highest for the treatment combination of mepiquat chloride at 250 ppm and 30 × 10 cm. supported by (Kumar *et al.*, 2017) [9]. Although the higher pods plant^{-1} (46.94) and seeds pod-1 were obtained with a spacing of 30 × 10 cm, the yield was better with a spacing of 30 × 10 cm because to the higher plant population in comparison to broadcasting. Wider spacing results in higher yields because individual crops are better able to absorb moisture and nutrients, which is supported by Kabir and Sarkar (2018) [5].

Table 1: Effect of nipping and spacing on yield attributes of horse gram

Treatments	Number of branches plant^{-1}	Pods plant $^{-1}$	Seeds pod^{-1}	1000 seed weight (g)
Spacing (S)				
C1 – Broadcasting	8.02	41.46	5.04	31.39
C2 – Line sowing at (30 cm×10 cm)	10.59	44.95	5.39	32.15
SEm±	0.23	0.85	0.10	0.47
CD (P=0.05)	0.71	2.55	0.30	NS
Nipping (N)				
N1 – No nipping	7.00	32.44	4.49	30.27
N2 – Manual nipping at 25 DAS	8.83	40.66	4.77	31.42
N3 – Manual nipping at 25 and 40 DAS	9.61	42.38	5.10	31.80
N4 – Mepiquat chloride at 250 ppm	11.19	55.60	5.99	33.26
N5 – Chlormequat chloride at 250 ppm	9.88	44.94	5.71	32.09
S.Em ±	0.37	1.35	0.16	0.74
CD (P=0.05)	1.12	4.04	0.48	NS

Seed yield

Data related to seed yield is presented in table 2. Mepiquat chloride at 250 ppm + 30×10 cm, among the treatment combinations, had the highest yield (946 kg ha-1) with a yield increase of 32.9 percent when nipping was used in place of no nipping. According to (Khan *et al*., 2018) [6], the increased yield is caused by a higher number of lateral branches, which result in a higher number of pods. Spraying of mepiquat chloride results in increased photosynthetic rate and efficient translocation of photosynthates to reproductive parts that results in higher number of pods and seed yield which are in line with (Jaidka *et al.*, 2018) [4].

Table 2: Effect of nipping and spacing on yield of horse gram

Treatments	Seed yield kg (ha^{-1})	Straw yield (kg ha^{-1})	Harvest index
Spacing (S)			
C1 – Broadcasting	746	2520	22.41
C2 – Line sowing at (30 cm×10 cm)	795	2720	22.54
SEm±	6.93	14.76	0.18
CD (P=0.05)	20.76	44.21	NS
Nipping (N)			
N1 – No nipping	628	2324	21.28
N2 – Manual nipping at 25 DAS	727	2400	23.24
N3 – Manual nipping at 25 and 40 DAS	796	2569	23.67
N4 – Mepiquat chloride at 250 ppm	867	2968	21.71
N5 – Chlormequat chloride at 250 ppm	835	2841	22.49
S.Em. ±	10.96	23.34	0.29
CD (P=0.05)	32.82	69.91	NS

Conclusion

According to the results of the above study, spraying mepiquat chloride at a concentration of 250 ppm with a spacing of 30 ×10 cm is advised for improved horse gram production.

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