Effect of pinching and foliar sprays on seed yield and quality of Dhaincha (*Sesbania aculeate*)

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Abstract

The experiment was conducted on variety DH 1 to assess the effect of pinching and foliar sprays on seed yield and quality of Dhaincha during rainy season (July to October) 2017 in Haryana, India. Significant effect of pinching and foliar sprays on seed yield and quality was observed and greater number of pods/ plant (89.07), number of seeds/pod (28.27) and seed yield (5.97 q/ha) was observed in pinching while the seed quality was found better in without pinching. Among the treatments, highest seed yield and yield attributing characteristics were observed in treatment T_4 (sprayed with DAP @ 2% + MN mixture ($ZnSO_4$ @ 0.5% + Boric acid @ 0.3%) + NAA @ 40 ppm by registering highest number of pods/ plants (94.34), number of seeds/pod (30.17), seed yield (7.88 q/ha), 1000 seed weight (17.45g), seed germination (78.67%), seedling length (15.67cm) and vigour Index (1235.5) followed by T_1 (Foliar spray with DAP @ 2%). The total cost of production in pinching was Rs.13535 that was 10.2% higher than without pinching which was due to labour used in pinching. The gross return calculated in pinching was Rs.14236 which was higher (Rs.1666) as compared to without pinching seed production. The B:C ratio was 1.05 and 1.03 in seed production by pinching and without pinching respectively.

Additional keywords: *Sesbania aculeata*, pinching, seed quality, economics

Introduction

Dhaincha (*Sesbania aculeata*), a member of the Fabaceae, is the cheapest and best source as compared to other green manure crops for improving soil fertility due to its fast growth, high biomass production and ability to convert large amounts of atmospheric nitrogen into a usable form for plants. It also increases water holding capacity of soil and bears more nodules which fix atmospheric nitrogen. Since the start of green revolution, which amongst other practice advocated the use of chemical fertilisers and pesticides, the role of green manures in maintaining soil fertility has been overlooked. One of the most important constraints in production and productivity of any crop is poor quality of seed due which results in poor crop stand establishment. Availability of viable and vigorous seed at planting time is important for achieving targets of agricultural production because good quality seed acts as a catalyst for realizing the full potential of other inputs *viz.*

fertilisers, irrigation, pesticides etc. Green manure crops are a cheap alternative to chemical fertilisers and is an inevitable practice in the years to come for sustainable agriculture. However, no practices have been standardized for seed production of Dhaincha. During the last few decades, increased use of high amounts of chemical fertilisers and high yielding crop varieties, and an increase in cropping intensity have enhanced food production. At the same time, the system is also responsible for enhancing micronutrient deficiency in soil, causing not only micronutrient malnutrition but also leading to lower content of micronutrients in plant parts and entire failure of crops. Seed production of Dhaincha will not only improve the soil health status by adding nutrients (nitrogen) and organic matter but it will also generate the extra income to farmers. Removal of apical dominance promotes the development of lateral buds thereby resulting in increased branches per plant (Pathania *et al*. 2000). For increasing production and productivity of any crop, availability of quality seed is very important. Foliar spray of nutrients and growth regulators result in high yield and better seed quality in many crops. Hence, the study was conducted to assess the influence of nipping/pinching and chemical sprays on seed yield and quality.

Materials and Methods

Experimental details

The experiment was conducted on Dhaincha variety DH-1 during rainy season (July to October) 2017 in the research area and laboratories of Department of Seed Science & Technology CCS, HAU, Hisar, Haryana (India) which is situated at Latitude: 29°10N, Longitude 73°43E, and at an elevation of 210 m above mean sea level.

Freshly harvested seed was procured from the medicinal, aromatic and under-utilized plants section, Department of Genetics and Plant Breeding, CCS, HAU, Hisar.

The experiment was laid out in a randomised block design with three replications in 5x4 m plots at 60x20 cm spacing. The sowing was done in two main-plots with pinching and without pinching and Nitrogen @ 30 kg/ha and Phosphorous @ 50 kg/ha were incorporated as a basal dose (at sowing time). Nipping was done 50 DAS. In sub-plots foliar spray was done with DAP @ 2%, MN Mixture ($ZnSO_4$ @ 0.5% + Boric acid @ 0.3%), NAA @ 40 ppm and their combinations.

Measurements

Observations were recorded on number of pods/plant**,** number of seeds/pod, seed yield per hectare, 1000 seed weight (g)**,** seed germination (%)**,** seedling length (cm), dry weight (g) and vigour index**,** and a cost benefit ratio was also calculated. Weather data was also recorded during the growing season. Ten effective plants were taken for determination of yield attributing characteristics. For determining germination percentage, one hundred seeds in three replications were placed in between sufficiently moistened rolled paper towels (BP) and kept at 20 °C in seed germinator. After 7 days, all seedlings were evaluated. Only normal seedlings were considered for percent germination determination as recommended in the International Seed Testing Association Rules (ISTA, 2011)**.** Ten normal seedlings were selected randomly at the time of final count of standard germination and average length of

ten seedlings was measured in centimeters. After measuring seedling length, seedlings were dried in a hot air oven for 24 hrs at 80±1°C. The dried seedlings of each replication were weighed, and average seedling dry weight was calculated. Seedling vigour index-I was calculated according to the method suggested by Abdul-Baki & Anderson (1973):

Vigour index–I = Germination (%) X average seedling length (cm).

The plants in the net plots were cut to the base and dried separately for one week. After drying, the crop plants were threshed by beating with sticks and seed was cleaned. Weight of the seed was recorded plot wise and expressed as kg ha^{-1}. The number of pods from five tagged plants were counted, averaged and expressed as number of pods per plant. 1000 seeds were counted from a sample drawn at random from the net plot seed yield and its weight was recorded in grams. Seed yield was obtained by taking the seed yield from net plot, sun dried thoroughly till a constant weight was recorded and expressed in kg per hectare.

Statistical Analysis

Experimental data was subjected to statistical analysis using analysis of variance procedures outlined for the design as per Panse & Sukhatme (1978). The analysis on cost of production was worked out on per hectare basis. Variable cost included cost for irrigation, seed, chemicals, fertilisers, cost of pinching, roguing, harvesting, threshing, processing and transportation charges which were considered at the prevailing market rates in this area. Interest on working capital was computed @ 9 per cent per annum for the period the crop maintained in the field. The total cost of production included the expenses incurred on inputs and various operations performed. In addition, rental value of land, management charges, risk premium were also included in total cost. Management charges and risk allowance were calculated @ 10 per cent of the variable cost. BC ratio was calculated by the formula-

$$B:C = \frac{\text{Gross Return}}{\text{Total Cost}}$$

Meteorological data on temperature (^{0}C), relative humidity (%), rainfall (mm) during the crop seasons are given in Table 1.

Table 1: Agro-meteorological data during the period of experimentation (2017).

Month	Temperature (^{o}C)		Relative humidity (%)		Wind speed (km/h)	Bright sunshine (h)	Rainfall (mm)
	Max	Min	Morning	Evening			
July, 2017	35.1	27.0	88.3	66.9	6.9	6.8	83.0
August, 2017	34.7	26.3	90.0	69.0	5.6	6.3	95.5
September, 2017	34.5	23.8	88.0	53.0	3.1	6.4	63.7
October, 2017	34.9	17.3	85.0	28.0	1.8	6.6	0.0

Results and Discussion

Significant effect of pinching and foliar sprays on seed yield and quality was observed. Greater number of pods per plant (89.07), number of seeds per pod (28.27) and seed yield (597 kg/ha) was observed in pinching while the seed quality was found better in without pinching (Table 2 and 3).

Table 2: Effect of pinching and foliar sprays on seed yield and yield attributing characters in Dhaincha.

Treatments	No of pods/plant			No of seeds/pod			Seed yield kg/ha		
	P_1	P_2	Mean	P_1	P_2	Mean	P_1	P_2	Mean
T_1	94.67	85.67	90.17	30.67	28.00	29.35	686	608	647
T_2	91.67	80.67	86.17	26.67	25.33	26.00	547	460	503
T_3	86.67	76.33	81.50	26.33	25.00	25.67	508	420	464
T_4	98.00	90.67	94.34	32.00	28.33	30.17	788	712	750
T_5	74.33	67.33	70.83	25.67	24.00	24.84	457	398	428
Mean	89.07	80.13		28.27	26.13		597	520	
CD at 5% T	2.88			1.40			7		
P	4.55			2.21			11		
P x T	NS			NS			NS		

Table 3: Effect of pinching and foliar sprays on seed quality parameters in Dhaincha.

Treatments	1000 seed weight (g)			Seed germination (%)			Seedling length (cm)			Vigour index		
	P_1	P_2	Mean	P_1	P_2	Mean	P_1	P_2	Mean	P_1	P_2	Mean
T_1	15.97	18.20	17.09	75.33	82.00	78.67	14.00	16.00	6.47	1069	1297	1183
T_2	16.77	17.53	17.15	76.00	76.67	76.34	11.67	15.00	5.03	887	1150	1018
T_3	17.20	17.50	17.35	76.00	76.67	76.34	12.00	14.00	4.64	911	1072	992
T_4	17.23	17.67	17.45	76.33	81.00	78.67	14.67	16.67	7.50	1105	1366	1236
T_5	17.37	16.80	17.09	75.00	76.33	75.67	13.33	13.00	4.28	999	991	995
Mean	16.91	17.54		75.73	78.53		13.13	14.93	5.58	994	1175	
CD at 5% T		0.248			1.242			0.843			71.76	
P		NS			1.964			1.333			113	
P x T		0.555			2.780			NS			NS	

T_1=Foliar spray with DAP @ 2%, T_2 = Foliar spray with MN Mixture ($ZnSO_4$ @ 0.5% + Boric acid @ 0.3%), T_3 = Foliar spray with NAA @ 40 ppm, T_4= Foliar spray with DAP @ 2% + MN Mixture ($ZnSO_4$ @ 0.5% + Boric acid @ 0.3%) + NAA @ 40 ppm, T_5= Control (Foliar spray with water only), P_1= Pinching, P_2= without pinching

Nipping at 50 days after sowing enhanced the number of seeds/pod and number of pods per plant and seed yield per acre but decreased seed quality parameters as compared to without pinching plots. The superiority in performance might be attributed to the prolonged assimilation activity of leaves thereby ensuring a considerable yield advantage (Vasilas *et al.* 1980). These results were similar in accordance with Kathiresan & Duraisamy, 2001 in the same crop and Tripathi *et al*. (2013) in sunhemp. Pinching of the Dhaincha crop might have diverted all the food material and led to higher biomass production resulting from more plant growth and development (Kumar & Srivastava 2013). Significant effect of sprays of micronutrients/chemicals was also observed. Among the treatments, highest seed yield and yield attributing characteristics were observed in treatment T_4 (sprayed with DAP @ 2% + MN Mixture ($ZnSO_4$ @ 0.5% + Boric acid @ 0.3%) + NAA @ 40 ppm by registering highest number of pods per plant (94.34), number of seeds per pod (30.17), seed yield (7.50 q/ha), 1000 seed weight (17.45g), seed germination (78.67%), seedling length (15.67cm) and vigour Index (1235) followed by T_1 *i.e.* foliar spray with DAP @ 2% (Table 2 and 3). The results were in confirmation with the results of Kokare e*t al.* (2006) in okra, Chandrasekhar & Bangarusamy (2003) in green gram, Doss *et al*. (2013) in black gram, Uma & Karthik (2017) in black gram, green gram, cowpea and horse gram. Further, the foliage-applied nutrients at the critical stages of the crop were effectively absorbed by the plant and translocated to the developing pods, producing a higher number of pods, increased filling and higher yield. Significant improvement in seed yield with spray of DAP, NAA and micronutrients like zinc and boron indicate that these nutrients play an important role in several enzymatic processes and are necessary for growth and development of the crop. They further contribute to increased branches, pods and seed yield. This could be attributed the important role boron plays in cell division, cell differentiation, development, calcium utilization, translocation of photosynthates and growth regulators from source to sink, and help in maintaining higher leaf area, leaf area index and higher number of pods per plant (Kalyani *et al.* 1993). It also helps in preventing flower drop, pod drop and thereby maintaining higher number of pods per plant. Revanthy *et al.* (1997) reported that foliar spray of DAP, NAA combined with micronutrients registered a higher grain yield. The causes for the increase in yield were the increased dry matter production and efficient assimilate translocation to the developing sink leading to increased pods and higher seed yield in groundnut.

The total cost of production in pinching was Rs.13535 that was 10.2% higher than without pinching which was due to labour used in pinching. The gross return calculated by pinching was Rs.14236 which was higher (Rs. 1666) as compared with the gross return obtained without pinching in terms of seed production. The B:C ratio was 1.05 and 1.03 in seed production by pinching and without pinching respectively. Hence, in Dhaincha seed production pinching is a beneficial practice (Table 4).

Table 4: Economics of pinching and without pinching in seed production of Dhaincha (in Indian Rupees).

Particulars/ Inputs	Pinching	Without pinching
Variable cost	6850	5590
Total cost	13535	12149
Gross return	14236	12570
Return over Variable cost	7386	6980
Net return	701	421
B:C Ratio	1.05	1.03

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