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Influence of pinching and foliar application of nutrients on seed yield and quality of Dhaincha (*Sesbania aculeata*)

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ABSTRACT : The field experiment was conducted during rainy season of 2015 to study the influence of pinching and foliar spray of nutrients on seed yield and quality of Dhaincha (*Sesbania aculeata*) at Pearl Millet Research Station, Junagadh Agricultural University, Jamnagar, Gujarat. Pinching of apical buds was done at 60 DAS and foliar spray was done two times *i.e.* first at initiation of flowering and second at end of flowering period. The results revealed that the plant pinched at 60 DAS recorded the highest values for number of pods per plant (86.00), dry pods yield per plant (19.50 g), dry pods yield (8.70q/ha), seed yield per plant (10.17g) and seed yield (4.81 q/ha) compared to without pinching. The foliar sprays of DAP 2% + micro nutrients (MN) mixture ($ZnSO_4$ 0.5% + boric acid 0.3%) + NAA 40 ppm produced higher number of pods per plant (91.63), dry pods yield per plant (20.99g), dry pods yield (9.43q/ha), seed yield per plant (11.04g) and seed yield (5.09q/ha). The highest seed yield (5.22q/ha) was recorded with pinching and foliar sprays of DAP 2% + MN mixture ($ZnSO_4$ 0.5% + boric acid 0.3%) + NAA 40 ppm besides with higher yield attributing parameters. These were closely followed by pinching x spray of MN mixture ($ZnSO_4$ 0.5% + boric acid 0.3%). The seed quality in terms of germination, seedling length, dry seedling weight and seed vigour index I and II were higher with pinching at 60 DAS followed by sprays of NAA @ 40 ppm at initiation of flowering and at end of flowering period.

KEY **W**ORDS : Dhaincha, Apical bud pinching, Foliar spray of nutrients, Seed yield, Quality

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Green manuring a practice of incorporation of green plant biomass into the cultivated fields is one of the most effective and environmentally sound methods of manuring crops. In-situ incorporation of green manure crops provides an opportunity to improve soil physico-chemical environment, cut down the use of chemical fertilizers, which are often blamed for causing environmental pollution and escalating the cost of cultivation of crops. Interest towards green manure crops has been renewed with the growing emphasis on sustained soil productivity in agricultural systems. The benefits deriving from green manure crops are directly related to the amount of biomass and nutrients added into the soil. Biomass production of green manure crops varies widely

according to the species of the legumes, environmental conditions, nature of incorporation, native soil fertility, crop management practices and age of green manure crops at the time of incorporation.

Almost all green manure crops which are used for in-situ or ex-situ incorporation contain all the plant nutrients which are essential for growth and development of any plant species. Among the different green manure crops, Dhaincha (*Sesbania aculeata*) and sunhemp (*Crotalaria juncea*) have higher accumulation of major and micro nutrients on account of more biomass production and better nutrient composition compared to food legumes which are inferior due to low content of nutrients coupled with less dry matter production. Dhaincha is the cheapest and best source for improving soil fertility and maintaining the health of a soil ecosystem. It also increases water holding capacity and decreases soil loss by erosion. Dhaincha is an ideal green manure crop as it is quick growing, succulent, easily decomposable with low water requirement and produces maximum amount of biomass. It is quick germinating and fast growing crop and bears more number of nodules which fix atmospheric nitrogen. In Dhaincha, quality seed availability has become problematic to both farmers and government agencies. Hence, timely production and supply of green manure crop seeds especially "*Sesbania aculeata*" at cheapest rates in the state has been given the priority for procurement of the seed and to make it available well in advance to the farmers. Off late, quality seed production of Dhaincha is under meagre importance in spite of huge demand from farmers and less expertise was carried out in the State. Keeping in view, the experiment was planned to study the influence of pinching and foliar spray of nutrients on seed yield and quality of Dhaincha during *Kharif* 2015.

RESEARCH PROCEDURE

The field experiment was conducted at Seed Technology Research Unit, Pearl Millet Research Station, Junagadh Agricultural University, Jamnagar (Gujarat) during *Kharif* season of 2015. The experiment was laid down in split plot design in four replications. The main plot treatments were with pinching and without pinching. Sub plot treatments were foliar spray with DAP 2%, foliar spray with micro nutrient (MN) mixture ($ZnSO_4$ 0.5% + boric acid 0.3%), foliar spray with NAA @ 40 ppm, foliar spray with DAP + MN mixture (Zn+B)+ NAA and control. Pinching of apical buds was done at 60 DAS to break apical dominance and more branching. Foliar spray was done two times *i.e.* first at initiation of flowering and second at end of flowering period. The crop was sown on 31st July, 2015with a spacing of 60 x 20 cm. The plot size was kept of 5.00 × 3.60 m. The crop was thinned at 15 DAS to maintain plant to plant distance 20cm within row. The station received total rainfall of 294mm during crop season. The soil of the experiment was medium black. The fertilizer was applied @ 30 kg/ha N and 50 kg/ha P. In addition, the recommended agronomic packages and plant protection practices were followed. The field observations were made on five randomly selected plants in each treatment plots on number of pods per plant, number of seeds per pod, dry pods yield per plant (g) and seed yield per plant (g), while, observations on dry pods yield and seed yield were recorded on plot basis in kilogram and converted into quintal per hectare. After harvesting the crop, the seed quality parameters *viz*., 100-seed weight (g), seed germination percentage, seedling length (cm), dry seedling weight (g) and seedling vigour Index-I and II were assessed in laboratory. The germination test was conducted in the laboratory using between paper methods as per ISTA (2007). The seedling vigour index was calculated as per the formula given by Abdul Baki and Anderson (1973). The data were statistically analyzed as per the method outlined by Panse and Sukhatme (1978).

RESEARCH ANALYSIS AND REASONING

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads:

Influence of pinching (M):

Influence of pinching on all the characters under studied was found non-significant (Table 1). However, the higher production of seed yield (4.81q/ha) was obtained with pinching as compared without pinching (4.68q/ha). The higher seed yield observed under the influence of pinching might be attributed to growth characteristics which resulted in considerable improvement in yield attributing characters like pods per plant, dry pods yield per plant and seed yield per plant and finally reflected into yield. The results are in

conformity with the findings of Bhattacharjee and Mitra (1999) and Jagannatham *et al*. (2008) in Mesta, Kathiresan and Duraisamy (2001) and Nayak (2016) in Dhaincha. In the present study, beneficial influence with pinching on seed yield per plant (10.17g), number of pods per plant (86.00), dry pods yield per plant (19.50g) and dry pods yield (8.70q/ha) were noticed compared to no pinching. On contrary, pinched plants took relatively less number of seeds per pod (26.65) as compared no pinching (27.11). It has been well established fact that arresting vegetative growth with pinching of apical bud in several flower and vegetable crops result in production of more number of branches which turn influence seed yield and yield parameters as reported in coriander by Thakral *et al.* (1991) and Baboo and Rana (1995) and Gill *et al.* (2001) in fenugreek. In the present study, 100-seed weight was decreased with pinching (0.57 g) as compared to no pinching (0.62 g). Tripathi *et al.* (2013) reported non-significant difference in test weight of sun hemp due to topping. Tomar *et al*. (2004) and Bhat and Shepherd (2007) observed significant reduction in 1000 seed weight due to pinching treatment. Reduction in individual flower size and weight under pinching might have produced smaller seeds which in turn might have reduced the 1000 seed weight. In the present investigation, the seed quality parameters were also influenced by pinching treatment compared no pinching. The higher seed germination (88.60%), seedling length (6.96cm), dry seedling weight (1.147g), seed vigour index I (615.01%) and seed vigour index II (102.06%) were recorded with pinching compared to no pinching. Beneficial effect found with pinching perhaps could be related to effective synthesis and translocation of photosynthates from source to sink which is evident with higher seed germination, seedling length, dry seedling weight and vigour index. The results are in conformity with the findings of Tomar *et al.* (2004); Bhat and Shepherd (2007); Sunitha *et al.* (2007); Mohanty *et al.* (2015) and Nayak (2016).

Influence of foliar application of nutrients (T):

Influence of foliar application of different nutrients was found significant for dry pods yield per plant, seed yield per plant and seed vigour index I. The remaining traits studied were reflected non-significant. The foliar sprays of DAP 2% + MN mixture ($ZnSO_4$ 0.5% + boric acid 0.3%) + NAA 40 ppm produced the highest seed yield (5.09q/ha) followed by sprays of MN mixture ($ZnSO_4$ 0.5% + boric acid 0.3%) and DAP 2%. The foliar sprays of DAP 2% + MN mixture ($ZnSO_4$ 0.5% + boric acid 0.3%) + NAA 40 ppm recorded significantly the highest seed yield per plant (11.04g) over control (8.66 g). Similarly, the foliar sprays of MN mixture ($ZnSO_4$ 0.5% + boric acid 0.3%) also recorded significantly higher seed yield per plant (10.83g) and dry pods yield per plant (21.22g) over control (T_5). However, this treatment (T_2), *i.e.* foliar sprays of MN mixture ($ZnSO_4$ 0.5% + boric acid 0.3%) was found to produce more number of pods per plant (93.38), higher dry pods yield (9.15q/ha) and seed yield (4.95q/ha) in Dhaincha. The foliage applied nutrients at the critical stages of the crop were effectively absorbed by the plant and translocated to the developing pods, producing more number of pods, more filling and higher yield (Nayak, 2016). Significant improvement in seed yield with spray of secondary nutrients like sulphur, 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 to the fact that boron plays an important role in cell divisions, 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). The foliar application of potassium nitrate @ 2% + boric acid @ 50 ppm + zinc sulphate @ 1% at 60 DAS to soybean was found superior in increasing plant height, number of branches, number of leaves, leaf area, total dry matter, number of pods per plant, test weight and seed yield in soyabean followed by potassium nitrate @ 2% + boric acid @ 50 ppm at 30 and 60 DAS compared to control (Gowthami and Rama Rao, 2014). In the present investigation, the seed quality parameters were also influenced by foliar sprays of different nutrients. The higher test weight (0.63g), seed germination (92.50%), dry seedling weight (1.230g), seed vigour index I (711.58%) and seed vigour index II (113.36%) were recorded with sprays of NAA @ 40 ppm compared to all other treatments. Kavimani *et al.* (1997) reported maximum seed weight and seed yield in Dhaincha with soil application of single super phosphate (20 kg/ha) along with foliar spray of DAP (2%) at flowering stage as compared to single application of both. Kathiresan and Duraisamy (2001) found that the foliar sprays of 2% DAP + 1% K increased the shoot length, shoot dry weight and number of branches per plant in

Dhaincha.

Influence of pinching x foliar application of nutrients interaction (M x T):

Interaction effect of pinching x foliar application of nutrients was found non-significant for all the characters studied. However, among the interaction effects, M_1T_4 *i.e.* pinching at 60 DAS followed by sprays of DAP 2% + MN mixture ($ZnSO_4$ 0.5% + boric acid 0.3%) + NAA 40 ppm produced the highest seed yield (5.22q/ha) and dry pods yield (9.72q/ha). Similarly, out of 10 treatment combinations, foliar sprays of MN mixture ($ZnSO_4$ 0.5% + boric acid 0.3%) with pinching recorded the maximum number of pods per plant (101.50), number of seeds per pod (27.70), dry pods yield per plant (23.31g) and seed yield per plant (11.55g). The perusal of Table 1 revealed that among the interaction effects, M_1T_3 *i.e.*pinching with foliar application of NAA @ 40 ppm was manifested maximum germination (92.75 %), seedling length (7.84 cm), dry seedling weight (1.285 g), seed vigour index I (723.48%) and II (118.02%). Thus, it is evident from the present study that seed yield and seed quality parameters could be increased by pinching of apical buds at 60 DAS followed by foliar sprays of either DAP 2% + MN mixture ($ZnSO_4$ 0.5% + boric acid 0.3%) + NAA 40 ppm or MN mixture ($ZnSO_4$ 0.5% + boric acid 0.3%) at initiation of

Table 1: Influence of pinching and foliar application of nutrients on seed yield and quality parameters of Dhaincha

Treatments		Seed yield (q/ha)	Seed yield /plant (g)	No. of pods/ plant	No. of seeds/ pod	Dry pods Yield/ plant (g)	Dry pods yield (q/ha)	100-seeds weight (g)	Seed germination (%)	Seedling length (cm)	Dry seedling weight (g)	Seed vigour index-I (%)	Seed vigour index-II (%)
Pinching of apical buds at 60 DAS (M)													
M_1		4.81	10.17	86.00	26.65	19.50	8.70	0.57	88.60	6.96	1.147	615.01	102.06
M_2		4.68	9.56	80.05	27.11	18.21	8.44	0.62	87.75	6.79	1.117	596.87	98.48
S.E. ±		0.26	0.22	2.64	0.12	0.51	0.31	0.028	0.39	0.19	0.021	18.52	1.55
C.D. (P=0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %		24.03	9.90	14.21	1.94	12.11	17.65	21.02	1.95	12.24	8.31	13.67	6.91
Foliar application of nutrients (T)													
T_1		4.71	9.31	77.25	26.46	17.95	8.52	0.60	88.00	6.68	1.119	584.79	98.89
T_2		4.95	10.83	93.38	26.83	21.22	9.15	0.58	87.63	6.61	1.107	580.34	97.68
T_3		4.50	9.47	80.13	27.64	18.40	7.87	0.63	92.50	7.71	1.230	711.58	113.36
T_4		5.09	11.04	91.63	26.85	20.99	9.43	0.60	86.63	7.23	1.107	627.73	96.34
T_5		4.46	8.66	72.75	26.60	15.72	7.87	0.57	86.13	6.15	1.098	525.28	95.09
S.E. ±		0.33	0.58	5.47	0.47	1.24	0.48	0.054	2.51	0.42	0.043	39.10	5.63
C.D. (P=0.05)		NS	1.69	NS	NS	3.62	NS	NS	NS	NS	NS	114.12	NS
C.V. %		19.54	16.60	18.63	4.93	18.57	15.81	25.67	8.03	17.12	10.85	18.25	15.95
Interaction effects (M x T)													
M_1	T_1	4.68	9.32	76.75	26.05	17.61	8.31	0.52	91.50	6.76	1.156	613.55	106.13
	T_2	5.18	11.55	101.50	27.70	23.31	9.27	0.54	85.00	6.64	1.069	564.83	91.83
	T_3	4.65	9.69	81.75	27.58	18.81	8.54	0.60	92.75	7.84	1.285	723.48	118.02
	T_4	5.22	11.45	96.00	26.23	21.95	9.72	0.64	88.50	7.54	1.140	666.80	101.39
	T_5	4.33	8.82	74.00	25.68	15.83	7.67	0.56	85.25	6.03	1.084	506.40	92.95
M_2	T_1	4.74	9.30	77.75	26.88	18.30	8.73	0.67	84.50	6.59	1.081	556.03	91.65
	T_2	4.73	10.11	85.25	25.95	19.12	9.03	0.62	90.25	6.58	1.146	595.85	103.53
	T_3	4.35	9.25	78.50	27.70	17.98	7.20	0.66	92.25	7.58	1.175	699.68	108.70
	T_4	4.97	10.62	87.25	27.48	20.03	9.14	0.56	84.75	6.93	1.074	588.65	91.29
	T_5	4.59	8.50	71.50	27.53	15.62	8.08	0.58	87.00	6.28	1.110	544.15	97.24
S.E. ±		0.46	0.82	7.73	0.66	1.75	0.69	0.08	3.54	0.59	0.06	55.29	7.99
C.D. (P=0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

M_1=With pinching, M_2= Without pinching, 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.
NS=Non-significant

flowering and at end of flowering period in Dhaincha.

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