Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; Sp 9(5): 728-730
Received: 23-08-2020
Accepted: 07-10-2020

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Growth, yield and economics of dhaincha as influenced by spacing and detopping practices

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Abstract
The study entitled "Growth, yield and economics of dhaincha as influenced by spacing and detopping practices" was conducted during *Kharif* 2019 in split plot design with three spacing as main plot treatment (S_1- 60 cm × 10 cm, S_2- 90 cm × 10 cm, S_3- 120 cm × 10 cm) and four detopping as sub plot treatment (D_0- Control- no topping, D_1- detopping at 30DAS, D_2- detopping at 45 DAS and D_3- detopping at 60 DAS) with three replications.
The spacing 60 cm × 10 cm (S_1) recorded significantly higher seed yield (1045.7 kg ha^{-1}), stalk yield (8190.2 kg ha^{-1}), GMR (73198 Rs ha^{-1}), NMR (56709 Rs ha^{-1}) and B: C ratio (4.43) over the other spacing treatments viz. 90 cm × 10 cm (S_2) and 120 cm × 10 cm (S_3).
Detopping at 30 DAS (D_1) recorded significantly higher seed yield (923.4 kg ha^{-1}), stalk yield (7101.5 kg ha^{-1}), GMR (64639 Rs ha^{-1}), NMR (48460 Rs ha^{-1}) and B: C ratio (3.98) over the other detopping treatments viz. Control (D_0) and detopping at 60 DAS (D_3). However detopping at 45 DAS (D_2) was found to be at par with detopping at 30 DAS (D_1).

Keywords: Dhaincha, spacing, detopping, yield, economics

Introduction
Dhaincha (*Sesbania aculeata* Pers.) is a leguminous crop, large genus of herbs and shrubs. It is used as animal feed and for the green manuring. Dhaincha crop makes good growth within short period about 2-4 months (for green manuring), having straight stem up to 6 m in height which is very soft in nature, the leaflets of crop are very tender and produces maximum amount of organic matter. In this respect dhaincha is a potential green manure crop which can produce up to 22.5 tonnes ha^{-1} of biomass, the highest among all green manure crops and has nutrient content 3.3%N, 0.7% P, and 1.3%K. It is annual crop with lower C: N ratio. reported that 12-15% of yield of rice was increased by green manure with dhaincha crop. Roots of dhaincha crop produce large number of bacterial nodules through which fixes large amount of atmospheric nitrogen in the soil. Besides green manuring, it is also used as cover crop. It protects soil from water and wind erosion.
Seed production of dhaincha will not only improves the soil health status by adding nutrients (nitrogen) and organic matter but it will also generate the extra income to farmers. The lack of availability of adequate quality seeds at appropriate time at reasonable price for small holdings and marginal farmers becomes a major constraint in dhaincha cultivation. Quality seed production of dhaincha is given meager importance in spite of huge demand from farmers.
It is known fact that optimum spacing provides sufficient light to all the plants which increases the rate of photosynthesis and consequently dry matter production. In case of *Sesbania aculeata* proper spacing provides sufficient interception of light and satisfactory absorption of nutrients and water from the soil due to the proper development of root system and results in higher crop yield.
Detopping is the act of mowing or cutting the aerial part of a crop. Detopping of terminal buds is carried out two months after sowing to encourage more branching along with improve seed yield. Removal of apical dominance promotes the development of lateral buds thereby resulting in increased branches per plant (*Pathania et al.*, 2000) [6]. Hence the experiment was conducted with objectives to find out the optimum spacing, optimum time period of detopping for better branching with their economics

Material and Methods
A field experiment was carried out at Agronomy Section Farm, College of Agriculture, Nagpur during *kharif* season of 2019-20 to study the Growth, yield and economics of dhaincha as influenced by spacing and detopping practices. The soil of the experimental plot was clayey in texture, low in available nitrogen (205.18 kg ha^{-1}),

medium in available phosphorous (17.16 kg ha^{-1}) and very high in available potash (420.45 kg ha^{-1}) with pH 7.7. The experiment was conducted during *Kharif* 2019 in split plot design with three spacing as main plot treatment (S_1- 60 cm × 10 cm, S_2- 90 cm × 10 cm, S_3- 120 cm × 10 cm) and four detopping as sub plot treatment (D_0- Control- no topping, D_1- detopping at 30 DAS, D_2- detopping at 45 DAS and D_3- detopping at 60 DAS) with three replications. Local variety of dhaincha was sown at spacing as per the treatments. A uniform dose of 25: 25: 00 kg NPK ha-^{1} was applied to all the treatments. Similarly all the detopping practices were imposed as per treatments. No accountable incidence of any disease and insect pest was observed during the crop life period. The data was recorded as per the standard procedure.

Result and Discussion

Effect of spacing levels

Data in Table 1 revealed that, The spacing 60 cm × 10 cm (S_1) recorded higher plant height and number of branches plant^{-1} over the spacing 90 cm × 10 cm (S_2) and 120 cm × 10 cm (S_3), while the spacing 120 cm × 10 cm (S_3) recorded significantly higher Dry matter accumulation plant^{-1}(g) over the spacing 60 cm × 10 cm (S_1) however it was at par with spacing of 90 cm × 10 cm (S_2) at harvest. The spacing 120 cm × 10 cm also recorded the highest value of yield attributing characters viz. number of pods plant^{-1}, pod weight plant^{-1}(g), seed yield plant^{-1} (g) and stalk yield plant^{-1}(g) at harvest, over the spacing 60 × 10 cm (S_1) and found to be at par with spacing 90 cm × 10 cm (S_2). The better performance of plants at wider row spacing may be attributed to least inter plant competition and greater availability of growth resources i. e. light, moisture and nutrients. The results are in close agreements with the findings of Tripathi *et al.* (2013) [9], Parlawar *et al.* (2001) [5] and Pushpa *et al.* (2013) [7].

The spacing 60 cm × 10 cm (S_1) recorded significantly higher seed yield (1045.7 kg ha^{-1}), stalk yield (8190.2 kg ha^{-1}), GMR (73198 Rs ha^{-1}), NMR (56709 Rs ha^{-1}) and B: C ratio (4.43) over the other spacing treatments viz. 90 cm × 10 cm (S_2) and 120 cm × 10 cm (S_3). Wider spacing recorded higher value of vegetative and reproductive growth parameter of individual plant over narrow spacing. However in terms of seed yield ha^{-1}, stalk yield ha^{-1}, GMR ha^{-1} and NMR ha^{-1} narrow spacing found superior over wider spacing might be due to the fact that plant stand ha^{-1} was higher over wider spacing and this higher number of plants in area given higher yield. The results are in confirmation with the findings of Venkanna *et al.* (2013) [10] and Sangeetha *et al.* (2011) [8].

Effect of detopping levels

Among the different detopping practices the plant height at harvest was significantly influenced by the control treatment i.e. non topping(D_0) recorded the maximum and significantly higher plant height and was at par with by detopping at 60 DAS(D_3). Taller plant was registered with no topping practice, might be due to the fact that plants were not topped and as such plant grows to their original height without reduction. While the growth characters i.e. number of branches plant^{-1}, dry matter accumulation plant^{-1}(g) and yield attributing characters i.e. number of pods plant^{-1}, pod weight plant^{-1}(g), seed yield plant^{-1}(g), stalk yield plant^{-1}(g) and test weight (g) recorded significantly higher values by detopping at 30 DAS(D_1) over detopping at 60 DAS(D_3) and control(D_0) however it was at par with detopping at 45 DAS(D_2). The increment in yield attributes under the influence of topping might be attributed to better growth characteristics like dry matter accumulation plant^{-1} coupled with profuse branching. Results obtained are in accordance with those recorded by Gopal *et al.* (2016) [2], Mandal *et al.* (2017) [4] and Tripathi *et. al.* (2013) [9].

Among the different detopping treatments, detopping at 30 DAS (D_1) recorded significantly higher seed yield (923.4 kg ha^{-1}), stalk yield (7101.5 kg ha^{-1}), GMR (64639 Rs ha^{-1}), NMR (48460 Rs ha^{-1}) and B: C ratio (3.98) over the other detopping treatments viz. Control (D_0) and detopping at 60 DAS (D_3). However detopping at 45 DAS (D_2) was found to be at par with detopping at 30 DAS (D_1). These results are in agreement with Dedhi *et al.* (2017) [1], Tripathi *et al.* (2013) [9] and Jadhav (2018) [3].

Table 1: Growth and yield attributes yield and economics of dhaincha as influenced by different treatments

Treatments	Plant height (cm)	No. of branches plant^{-1}	Dry matter plant^{-1} (g)	No. of pods plant^{-1}	Pod weight plant^{-1} (g)	Seed yield plant^{-1} (g)	Stalk yield plant^{-1} (g)	Test weight (g)	Seed yield (kg ha^{-1})	Stalk yield (kg ha^{-1})	GMR (Rs ha^{-1})	NMR (Rs ha^{-1})	B: C ratio
Spacing levels (S)													
S_1– 60 cm × 10 cm	249.2	9.18	44.65	120.1	28.81	6.34	49.65	15.6	1045.7	8190.2	73198	56709	4.43
S_2- 90 cm × 10 cm	245.4	9.16	54.10	129.7	33.87	7.45	59.10	15.3	817.8	6487.0	57247	41248	3.58
S_3- 120 cm × 10 cm	246.6	8.83	60.51	135.3	37.40	8.23	65.51	15.2	675.5	5378.3	47283	31774	3.05
SE (m)±	3.5	0.34	3.17	4.4	1.50	0.34	3.65	0.22	49	470.13	3330	3330	-
CD (5%)	NS	NS	9.48	NS	4.49	0.99	10.75	NS	142.5	1407.4	9976	9976	-
Detopping levels (D)													
D_0 – Control	256.6	8.21	56.03	114.7	31.56	6.94	54.03	15.2	789.4	6940.7	55256	39797	3.57
D_1 – 30 DAS	238.7	9.44	56.90	140.3	36.48	8.02	62.90	16.1	923.4	7101.5	64639	48460	3.98
D_2 – 45 DAS	241.3	9.49	52.94	132.5	34.11	7.50	59.94	15.2	869.2	6711.0	60844	44665	3.74
D_3 – 60 DAS	251.7	9.09	46.48	125.9	31.30	6.89	56.47	15.0	803.3	5987.4	56231	40052	3.46
SE (m)±	4.6	0.30	2.03	3.7	1.16	0.26	2.13	0.25	32.3	258.6	2263	2263	-
CD (5%)	13.6	0.90	6.02	10.9	3.45	0.76	6.33	0.76	96.0	768.3	6721	6721	-
Interaction (S × D)													
SE (m)±	8.0	0.52	3.51	8.4	2.01	0.44	3.69	0.43	56.0	446.0	3919	3919	-
CD (5%)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-

Interaction effect

Interaction effect between different spacing and detopping levels on growth, yield attributing characters, yield and economics was found to be non significant.

Conclusion

Spacing of 60 cm × 10 cm and detopping at 30 to 45 DAS found to be the best for highest seed yield (kg ha^{-1}) in dhaincha. Spacing of 60 cm × 10 cm recorded highest gross

monetary returns (Rs ha^{-1}), net monetary returns (Rs ha^{-1}) and B: C ratio in dhaincha. Detopping at 30 DAS recorded highest gross monetary returns (Rs ha^{-1}), net monetary returns (Rs ha^{-1}) and B: C ratio in dhaincha and detopping at 45 DAS was at par.

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