J. Bangladesh Agril. Univ. 1(1): 13–17, 2003 ISSN 1810-3030

Seed production of *Sesbania rostrata* through vegetative propagation

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Abstract

Three field experiments were conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh to determine the suitable age of mother plant for stem cutting, the appropriate length of cutting, and the optimum date of planting, spacing and dose of TSP for seed production of *Sesbania rostrata*. These experiments were conducted during July to December each year of 2000 to 2002. Each of the experiments was set in a Randomized Complete Block design with four replications. Results indicated that for seed production of the crop through vegetative means, it might be raised with top portion planted on 20 July. Neither the age of mother plant, length of cutting and their interaction nor the plant spacing, dose of TSP and their interaction had any significant effect on the plant characters and seed yield of the crop.

Keywords: *Sesbania rostrata*, Vegetative propagation, Seed production

Introduction

Sesbania rostrata (Brem and Obram) known as "*African dhaincha*" is an annual aquatic legume. It was introduced in Bangladesh in 1986 (FSRDP, 1986). It has been extensively used in many countries as green manuring nitrogen-fixing crop. It is commonly cultivated in Senegal (Berhaut, 1967). It is also used as biomass fuel, soil erosion protectant, fencing material, feed, fodder, trellis for climbing vines and even for making roof of huts (Bhuiya and Bari, 1989). It is a species of vigorous and fast growing habit with deep green colour containing 1.2% nitrogen, whereas locally available *Sesbania aculeata* contains 0.62% nitrogen (Sarkar, 1990). The nitrogen fixation potential of *Sesbania rostrata* has been estimated to be up to 200 kg ha^{-1} in 50 days (Rinaudo *et al.*, 1983). For growing *Sesbania rostrata* as green manuring crop, seed is a limiting factor. The seed yield of this crop is low, partly due to low yielding variety and partly due to lack of appropriate production technology. For seed production, seeding is done during April-May and harvested in the months of October-November. It takes about 7 to 8 months to produce seeds for which farmers have to sacrifice a main crop. Therefore, research should be done to solve the problem. Vegetative propagation of *Sesbania rostrata* can overcome this problem to some extent (Hossain *et al.*,1990). Through this technology more seed yield and quality seed may be obtained. Different portions of the plant can be used as propagating materials. This piece of work was, therefore, undertaken to determine the suitable age of mother plant for stem cutting, the appropriate length of cutting and the optimum date of planting, spacing and dose of TSP for seed production.

Materials and Methods

Three experiments were conducted at the Agronomy Field Laboratory to achieve the objectives during July 2000 to December 2002. Randomized Complete Block design with four replications was followed in all of these experiments. In all the experiments the unit plot size was 4m × 2.5m. The crops were harvested when 80% of the pods of the plants turned chocolate brown to black colour. Five plants from each plot were selected randomly for data collection. The rest plants of the plots were harvested separately for seed yield and the seeds from the five sample plants were added to it to determine the seed yield $plot^{-1}$.

Data collected for all of the experiments were those presented in Table 1 and 2 and these were analyzed statistically to test the significance of variance. The ANOVA for some of the observations and all plant characters were done as per design used in the experiment. The mean comparison of the treatment was evaluated by Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Experiment 1. Effect of different plant portion and date of planting on the seed yield and crop characters of *Sesbania rostrata*

The experiment was conducted during the period from July to December 2000 to evaluate the effect of different plant portions as planting materials and dates of planting on the crop characters and seed yield of *Sesbania rostrata.* The experiment consisted of three plant portions viz., top portion, middle portion and bottom portion and three dates of planting viz., 20 July, 30 July and 19 August 2000. *Sesbania rostrata* plants were collected from the early sown seedbed. The whole plant was cut into three pieces- top, middle and bottom portions. Length of each cutting was 50cm. All portions were cut obliquely (45^0) with a sharp knife having minimum injury. The cuttings were planted at a row spacing of 25 cm × 25 cm. The crop was harvested on 2 November 2000.

Experiment 2. Effect of age of mother plant and length of top cutting on the yield of *Sesbania rostrata* seed

This experiment was conducted during the period from May to December 2001 to evaluate the age of mother plant and length of top cutting on the crop characters and seed yield of *Sesbania rostrata.* The treatments consisted of four ages of mother plant viz. 50 day, 60 day, 70 day and 80 day and three lengths of cuttings viz., 40 cm, 50 cm and 60 cm. The cuttings were planted on 30 July 2001 at a spacing of 25 cm × 25 cm. The crop was harvested plot wise at pod maturity on 4 November 2001.

Experiment 3. Effect of spacing and TSP application on the seed production of *Sesbania rostrata*

The experiment was conducted during the period from May to December 2002 to evaluate the effect of spacing and phosphorus application on the seed production of *Sesbania rostrata.* The treatment consisted of two spacings of planting- 50 cm × 25 cm and 50 cm × 20 cm and four levels of phosphate fertilizer- 0, 50, 75 and 100 kg TSP ha^{-1}. Fifty centimeter long top of the plant was collected from 70-day-old mother plant. Planting was done on 29 July 2002. Harvesting was done at pod maturity.

Results and Discussion

Experiment 1

Plant height, number of branches $plant^{-1}$, number of pods $plant^{-1}$, length of pod, number of seeds pod^{-1}, 1000-seed weight, seed yield and weight of dry matter were significantly affected by different plant portions (Table 1). The tallest plant was produced from the planting of top portion. Bottom portion produced the shortest plant. Number of branches $plant^{-1}$, number of pods $plant^{-1}$, length of pod, number of seeds pod^{-1}, 1000-seed weight, seed yield and dry matter yield were the highest in the crop raised from the top portion which were significantly followed by middle and bottom portions planted crops. Bottom portion planted crop showed inferior performances in respect of the crop characters studied including the yield.

The effects of different dates of planting on most of the crop characters and yield components were significant except 1000-seed weight (Table 1). All crop characters tended to be inferior as planting delayed. The highest seed yield was obtained from the earliest date of planting i.e. 20 July planted crops. This was due to the production of highest number of branches and highest number of pods plant^{-1}, longest pods and greatest number of seeds pod^{-1}. Weight of dry matter was also highest from 20 July planting crops. Crops planted on 19 August showed poorest performance in respect of the characters studied.

Table 1. Effect of plant portions and date of planting on crop characters and yield of *Sesbania rostrata* seed

Treatment	Plant height (cm)	Branches plant^{-1} (no)	Pods plant^{-1} (no)	Length of pod (cm)	Seeds pod^{-1} (no)	1000-seed weight (g)	Seed yield (t ha^{-1})	Dry matter production (t ha^{-1})
Plant portion								
Top	181.90 a*	4.62 a	25.80 a	18.38 a	31.71 a	15.45 a	0.73 a	3.17 a
Middle	119.97 b	2.81 b	11.77 b	17.35 b	28.20 b	14.91 ab	0.40 b	1.40 b
Bottom	96.82 c	2.24 c	8.84 c	16.03 c	25.05 c	14.61 b	0.19 c	1.00 c
$S\bar{x}$	1.256	0.098	0.43	0.72	0.41	0.14	0.007	0.12
Level of significance	0.01	0.01	0.01	0.01	0.05	0.01	0.01	0.01
Date of planting								
20 July, 2000	145.81 a	3.98 a	17.80 a	18.00 a	29.22 a	15.10	0.60 a	2.30 a
30 July, 2000	139.41 b	2.94 b	17.40a	17.40 a	28.72 a	14.94	0.47 b	2.05 b
09 August, 2000	121.88 c	2.44 c	15.73a	15.73 a	28.82 a	15.11	0.42 c	1.70 c
19 August, 2000	120.48 c	2.41 c	10.76b	10.76 b	26.51 b	14.83	0.30 d	1.35 d
$S\bar{x}$	1.256	0.98	052	0.52	0.58	0.098	0.009	0.037
Level of significance	0.01	0.01	0.01	0.01	0.05	NS	0.01	0.01

*In a column, figures having common letter(s) do not differ significantly.
NS = Not significant

The interaction effect of different plant portions and dates of planting was significant in respect of all the crop characters studied (Table 2). The tallest plants were produced from top portion planted on 20 July and the shortest ones from the bottom portion planted on 19 August. Similarly, number of pods plant^{-1}, length of pod, number of seeds pod^{-1}, 1000-seed weight, seed and dry matter yields were found highest in the crop raised from top portion planted on 20 July. Based on the result of this experiment it may be concluded that top portion of *Sesbania rostrata* could be planted on 20 July for seed and biomass production.

Table 2. Interaction effect of plant portion and date of planting on crop characters and seed yield of *Sesbania rostrata*

Interaction (Date × Planting portion)	Plant height (cm)	Branches plant^{-1} (no)	Pods plant^{-1} (no)	Length of pod (cm)	Seeds pod^{-1} (no)	1000-seed weight (g)	Seed yield (t ha^{-1})	Dry matter production (t ha^{-1})
20 July 2000 × Top portion	193.87 a*	6.40 a	35.85 a	18.94 a	31.38 ab	15.46 ab	0.84 a	3.70 a
20 July 2000 × Middle portion	127.06 d	3.15 ed	10.80 efg	17.35 e	28.93 bc	15.03 ab	0.61 c	1.70 cd
20 July 2000 × Bottom portion	116.50 e	2.40 def	7.32 gh	17.11 ef	27.34 cde	14.78 ab	0.33 e	1.50 cd
30 July 2000 × Top portion	182.00 b	4.45 b	30.15 b	18.10 bc	31.27 ab	15.36 ab	0.82 a	3.67 a
30 July 2000 × Middle portion	133.92 d	2.70 cde	13.05 de	17.46 de	28.81 bc	14.68 ab	0.30 e	1.75 cd
30 July 2000 × Bottom portion	102.33 f	1.67 f	9.00 fgh	16.61 f	26.10 de	14.78 ab	0.27 e	0.74 d
9 August 2000 × Top portion	170.42 c	2.70 cde	25.25 c	18.01 bcd	33.04 a	15.64 a	0.70 b	3.15 ab
9 August 2000 × Middle portion	115.16 e	1.90 ef	13.40 de	17.56 cde	28.20 cd	15.11 ab	0.40 d	1.00 d
9 August 2000 × Bottom portion	80.06 g	2.72 cde	12.55 def	15.50 g	25.23 e	14.60 ab	0.16 f	1.00 d
19 August 2000 × Top portion	181.32 b	3.40 b	15.95 gh	18.55 ab	31.15 ab	15.36 ab	0.58 c	2.15 bc
19 August 2000 × Middle portion	103.72 f	2.05 ef	9.85 efgh	17.02 ef	26.83 cde	14.82 ab	0.31 e	1.15 cd
19 August 2000 × Bottom portion	76.40 h	1.80 f	6.50 h	15.00 h	21.54 f	14.32 b	0.01 g	0.76 d
$\overline{Sx}$	2.01	0.19	0.87	0.14	0.82	0.28	0.01	0.25
Level of significance	0.01	0.01	0.01	0.01	0.05	0.01	0.01	0.01

*In a column, figures having common letter(s) do not differ significantly

Experiments 2 and 3

None of the crop characters including seed yield was found to be significantly affected by the age of mother plant, length of top cutting and their interaction as studied in experiment 2 and that in response to plant spacing, dose of TSP and their interaction, as studied in experiment 3, was also statistically similar. So, the data in response to these treatments have not been presented. However, it might be said that, within the scope of the present study, irrespective of age of mother plant for stem cutting, length of stem cutting, and their interaction, and whatever plant spacing, dose of TSP or whichever of their combinations be used, the crop characters and seed yield of *Sesbania rostrata* would remain unaffected. This might has been a location specific result. This finding might not hold good at all times, places and agronomical conditions.

Acknowledgement

The financial support of the BAURES, Bangladesh Agricultural University, Mymensingh for conducting the experiment is gratefully acknowledged.

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