ISSN 0258-7122
Bangladesh J. Agril. Res. 35(1) : 227-234, March 2010

INFLUENCE OF SEED RATE AND METHOD OF SOWING ON THE PERFORMANCE OF BILATIDHONIA *(Eryngium foetidum* L.)

S. N. MOZUMDER[1], M. MONIRUZZAMAN[2]
S. M. M. RAHMAN[3], P. C. SARKER[4] AND S. M. FAISAL[5]

Abstract

A field experiment was conducted at ARS, Raikhali, Rangamati during October, 2003 to July 2005 to determine the optimum spacing and seed rate to maximize yield and profitability of Bilatidhonia *(Eryngium foetidum* L.). A factorial randomized complete block design was followed consisting four methods of sowing (D_1 = broadcast, D_2 = line sowing (10 cm), D_3 = line sowing (15 cm), and D_4 = line sowing (20 cm) and three levels of seed rate viz., S_1 = 20, S_2 = 30, and S_3 = 40 kg/ha. Broadcasting and closer spacing (10 cm) with 40 kg seeds/ha showed better performance in respect of yield, yield attributes and profitability. The maximum number of plants/rn^2 (590), fresh yield (46.89 t/ha), gross return (Tk. 1031 thousand), gross margin (Tk. 858.1 thousand/ha) and benefit cost ratio (5.32) were obtained from broadcast method of sowing with 40 kg-seed/ha.

Keyworeds : Seed rate and method of sowing, *Eryngium foetidum*.

Introduction

Bilatidhonia *(Eryngium foetidum* L.) belongs to the family Apiaceae, is a major cash crop in the hilly region of Bangladesh (Moniruzzaman, 2002). It is a promising horticultural crop and falls under spices and condiments. This crop can also be grown well in the other parts of the country. It is popular to the native consumers and recently remarkable quantities are being exported to the UK and Middle East markets. Leaves and tender stems of Bilatidhonia are used as spice, condiments and culinary herb (Anon., 2008). Medicinal values of these plants have also been reported. Asynchronized and uneven seed germination causes a high seed rate (40 kg/ha) which is one of the major problems for popularizing its cultivation throughout the country (Moniruzzaman *et al.*, 2000). In addition to this, unavailability of adequate amount of seed and high cost of seed also limits the cultivation of Bilatidhonia (Mozumder *et al.*, 2007). Among the cultural techniques, seed rate and sowing method are the important factors determining the crop yield. Plant population controls the crop yield that depends on seed rate and sowing methods. The farmers are getting deprived of benefit from Bilatidhonia cultivation due to suitable spacing and seed rate. It is assumed that

[1&5] Senior Scientific Officer (Horticulture), Hill Agricultural Research Station (BARI), Ramgarh, Khagrachhari Hiill District, [2]Senior Scientific Officer (Horticulture), Agricultural Research Station, BARI, Raikhali, Chandraghona, Rangamati Hill District, [3]Senior Scientific Officer (Horticulture), Horticulture Research Centre, BARI [4]Senior Scientific Officer, Seed Technology Division, BARI, Joydebpur, Gazipur-1701, Bangladesh.

sowing of seeds maintaining proper line spacing may reduce the seed rate which will reduce cultivation cost. On the other hand, line sowing might help in uniform growth of plants and easy intercultural operation.

Therefore, the present experiment was undertaken to determine the suitable seed rate and method of sowing for maximizing yield and profitability of Bilatidhonia.

Materials and Method

The experiment was conducted at the Agricultural Research Station, Raikhali, Rangamati in two consecutive cropping seasons (Rabi+Kharif-l) during October, 2003 to July 2005. The experimental field belonged to AEZ 29 and the soil was Piedmont plain having medium loamy to moderately fine texture (sandy clay loam). The soils had pH 5.4 and 1.48% organic matter. The total N, available P and available K were 0.077%, 8.1 µg/g, and 0.17 meq/l00g soil. The experiment was laid out in a factorial randomized complete block design having four levels of method of sowing viz., D_1 = broadcasting, D_2 = 10 cm, D_3 = 15 cm, and D_4 = 20 cm line spacing and three levels of seed rate viz., S_1 = 20, S_2 = 30, and S_3 = 40 kg seeds/ha. Seeds were sown on 15 December 2003 and 8 December 2004 for two consecutive years. Two adjacent beds measuring 3m × lm constituted a unit plot. The crop was fertilized with 150 kg N (in the form of urea), 75 kg P_2O_5 (in the form of TSP), 100 kg K_20 (in the form of MoP) and 10 tons well decomposed cowdung per hectare (Islam *et al.,* 2003). One-fourth of urea, one-half of MoP, and entire TSP and cowdung were applied during final land preparation. The rest of urea and MoP were applied in three equal installments at 30-day intervals started from 60 days after sowing. Line sowing required more number of labourers at the time of sowing but same labour was saved during intercultural operation. The seed rate was same in all sowing methods. As a result, all the sowing methods required similar cost of cultivation. All the intercultural operations, such as weeding, mulching and irrigation were done as and when required. In the first year experiment (2003-04), some plants were infected by leaf spot disease. Ridomil Gold and Rovral were sprayed two times at 10-day intervals but no visible improvement was observed. The leaf spot disease damaged a number of plants at later stage (after 3rd harvest) that caused less number of harvestable plants/m^2 and lowered yield in 2003-04. In 2004-05, the crop was disease free and no spray was required. A few number of flower stalks were produced and it was broken so that more leaves can be produced. The longest plants were harvested from the plot at every 20-day intervals when the leaves became succulent (from 1st week of May upto last week of June every year). Data on plant height, number of leaves/plant, length of leaf, width of leaf, length of tap root, and weight of single plant were taken from randomly selected 10 plants, while weight of plants/per plot and number of plants/m^2 were taken from one square meter area from each plot. Per hectare yield was calculated from

the accumulated fresh yield of plants/m^2. The data were compiled properly and analyzed statistically by MSTAT program and mean comparison was done following the Duncan's Multiple Range Test (Zaman *et al.,* 1987).

Results and Discussion

Most of the yield attributes significantly differed singly or in combination with method of sowing and seed rates in both the years. Some individual plant characters did not show significant variations with seed rates and method of sowing. The yield and yield attributing characters were discussed and presented year-wise along with pooled.

Effect of method of sowing: Most of the yield and yield attributing characters differed significantly except plant height, leaf length, and length of the tap root (Table 1). Wider spacing produced more number of leaves/plant than closer spacing and broadcasting. Higher number of leaves/plant (6.93) was obtained from 20 cm line spacing, which was statistically identical with 15 cm spacing (6.67) and it was minimum in broadcast sowing (5.84). Significantly wider leaves (2.18cm) were produced from 20 cm line spacing, while closer other spacing and broadcast sowing produced narrower leaves. The maximum weight of single plant (9.8g) was obtained from 10 cm spacing in 2003-04, but it was higher (8.62g) in 15cm spacing in 2004-05 but at par to broadcast sowings. The mean single plant weight was higher in 10 cm line spacing (9.15g) and it was lower in 20 cm spacing (8.58g). The average single plant weight was higher in closer spacing might be due to availability of uniform growth facilities than wider spacing where inter line spacing was more but intra-line spacing was insufficient because same amount of seeds were sown in different spacings. Actually, less number of seeds was sown per single line in closer spacing and more seeds were sown per row in wider spacing. As a result, some of the plants in wider spacing could not grow properly due severe intra-row competition. As a result, less number of plants reached harvestable size in wider spacing. On an average, the broadcast method produced the highest number of harvestable plants per unit area (497/m^2) in both the years followed by 10 cm line spacing (465/m^2) and the lowest number of plants from 20 cm spacing (4 13/m^2). In both the years, broadcast method produced higher fresh yields closely followed by closer spacing (10 cm) (Table 1). The maximum fresh yield (39.41 t/ha) was obtained from broadcast method closely followed by 10 cm spacing (37.91 t/ha) and it was lower in 20 cm spacing (30.83 t/ha). These result supports the report of Moniruzzaman (2002) that optimum plant population and proper spacing helps obtain higher yield in *Eryngium foetidum* L. It was observed that in wider line spacing, plant could not cover the inter-row areas and as a result, weeds were found to grow vigorously. On the other hand, excessive plant population in a row hamper the normal growth which caused some plants to remain under sized. As such, the wider line spacing showed an uneven growth of Bilatidhonia which resulted in lower number of harvestable plant and ultimately lower yield.

Table 1 Agronomic performance of Bilatidhonia with different seed rates and method of sowing.

Treatments	Plant ht. (cm)	No of leaves/ plant	Length of leaf (cm)	Width of leaf (cm)	Length of root (cm)	Wt. of single plant			No. of plants/m^2 (g)			Fresh yield (t/ha)		
						03-04	04-05	Pooled	03-04	04-05	Pooled	03-04	04-05	Pooled
Method of sowing (D)														
Broadcast (D_1)	18.5	5.84b	17.1	2.l0b	11.2	9.60a	8.41a	9.0la	449a	545a	497a	34.48a	44.33a	39.41a
10 cm (D_2)	18.5	6.27b	17.1	2.07b	10.9	9.80a	8.50a	9.15a	424ab	506a	465a	33.28a	42.54a	37.91a
15 cm (D_3)	18.1	6.67a	16.9	2.13b	11.3	8.90b	8.62a	8.76b	381b	485b	433b	27.20b	38.33b	32.76b
20 cm(D_4)	18.6	6.93a	17.0	2.18a	11.7	9.30ab	7.86b	8.58b	394b	481b	413c	28.40b	32.77c	30.58b
Seed rate														
20 kg/ha (S_1)	18.6	6.47	17.2	2.10	11.3	9.50	8.73a	9.12a	373c	399c	386c	28.32b	31.57c	29.95b
30 kg/ha (S_2)	18.3	6.53	17.1	2.13	11.4	9.30	8.49a	8.90ab	444a	505b	475b	31.66a	41.79ab	36.72a
40 kg/ha (S_3)	18.3	6.28	16.9	2.13	11.2	9.30	7.83b	8.57b	419b	572a	495a	32.52a	45.13a	38.83a
F test	ns	ns	ns	ns	ns	*	*	*	**	**	**	**	**	**
CV (%)	6.45	5.41	7.81	5.47	9.57	7.41	9.68	8.54	6.93	11.87	9.40	7.11	11.23	9.17

Means having same letter (s) or without letter are not significantly different by DMRT
'ns' means insignificant, * significant at 5% and **' significant at 1% probability level.

Effect of seed rate: Different seed rates had significant effect on yield and number of plant/m^2 (Table 1). Plant height, number of leaves/plant, length and width of leaf, and root length were not affected by different seed rates. Single plant weight was decreased with the increasing seed rates. Higher single plant weight (9.12g) was found in lower seed rate (20 kg seeds/ha), while it was significantly lower (8.57 g) in higher seed rate (40 kg seeds/ha). Number of harvestable plants/m^2 was increased with the increasing seed rates. The highest number of plants (495/m^2) was obtained from 40 kg-seed/ha and it was significantly lower in 20 kg seeds/ha (386 plants/m^2). These results are in conformity with the results of Moniruzzaman *et al.* (2000) who obtained maximum single plant weight in Bangladhonia *(Eiyngium foetidum* L.) at 20 kg-seed/ha and reported that single plant weight decreased but number of plants per unit area increased with increasing seed rate under all types of shades. Table 1 showed that fresh yield increased with increasing seed rates in both the years. On an average, higher mean fresh yield (38.83 t/ha) was obtained from 40 kg-seed/ha, which was statistically identical with 30 kg-seed/ha (36.72 t/ha). Mozumder *et al.* (2007) obtained maximum biomass production in Bangladhonia *(Eryngium foetidum* L.) with 40 kg-seed/ha in normal and with 30 kg-seed/ha with hormone treatment. The lowest fresh yield (29.95 t/ha) was obtained from 20 kg-seed/ha. This results are in resemblance with the reports of Moniruzzaman *et al.* (2000) who found that fresh yield of false coriander *(Eryngium foetidum)* increased upto 40 kg-seed/ha and declined thereafter. The higher seed rates ensure higher number of seedlings per unit area that helps increase yield but excess population hampers normal growth. As a result, large number of plants are not able to reach harvestable size. In that case, yield increased with increasing seed rates upto optimum level and then declined.

Interaction effect: Among the characters studied, weight of single plant, number of plants/m^2 and fresh yield were significantly affected by method of sowing and seed rate in both the years (Table 2.a and 2.b). Plant height, number of leaves/plant, length and width of leaf and length of roots did not differ significantly due to different combinations of seed rate and method of sowing (Table 2.a). Maximum single plant weight (l0 g) was obtained from the combination $D_2 \times S_1$ which was statistically similar with $D_1 \times S_1$ $D_1 \times S_3$, $D_2 \times S_2$ and $D_3 \times S_2$. The $D_1 \times S_3$ combination produced the maximum number of plants/m^2 (590), which was similar to $D_2 \times S_3$ (538) and it was the lowest in $D_4 \times S_1$ (373) (Table 2.a). In 2003-04, maximum number of plant was 496/m^2 and it was 694 plant/m^2 in 2004-05 in $D_1 \times S_3$ The maximum fresh yield was 40.00 t/ha in 2003-04 and it was 53.8 t/ha in 2004-05. The number of plants/m^2 and fresh yield were higher in 2004-05 than 2003-04 experiment. This might be due to early sowing (by one week), better seed germination and disease free crops facilitated more number of harvests at later stage, while in the first year leaf spot disease damaged

Table 2.a Interaction effect of seed rate and line spacing on the performance of Bilatidhonia

Interation	Plant ht. (cm)	No. of leaves/ plant	Length of leaf (cm)	Width of leaf (cm)	Length of root (cm)	Wt. of single plant (g)			No. of plant/m^2 (g)		
						03-04	04-05	Pooled	03-04	04-05	Pooled
$D_1 \times S_1$	18.2	5.87	16.2	2.08	11.3	9.5ab	8.85a	9.18a	380cd	392c	386c
$D_1 \times S_2$	18.9	5.87	17.6	2.11	11.7	9.0b	8.42ab	8.71b	471ab	559ab	515ab
$D_1 \times S_3$	18.3	5.80	17.4	2.10	10.6	10.3a	7.97b	9.14a	496a	684a	590a
$D_2 \times S_1$	19.2	6.33	18.1	2.09	11.5	10.9a	9.09a	10.00a	377cd	385c	381c
$D_2 \times S_2$	18.0	6.46	17.0	2.00	10.6	9.3ab	8.73a	9.02a	430bc	522ab	476ab
$D_2 \times S_3$	18.1	6.00	16.3	2.12	10.6	9.0b	7.69b	8.35b	464ab	612a	538a
$D_3 \times S_1$	18.9	6.80	17.6	2.08	10.8	8.3b	8.79a	8.55b	362d	434c	398c
$D_3 \times S_2$	17.6	6.60	16.6	2.16	11.5	9.7a	9.03a	9.37a	428bc	480b	454b
$D_3 \times S_3$	17.6	6.60	16.5	2.15	11.7	8.6b	8.04ab	8.32b	353d	541ab	447ab
$D_4 \times S_1$	18.1	6.86	16.7	2.17	11.6	9.3ab	8.l7ab	8.74b	373d	385c	379c
$D_4 \times S_2$	18.7	7.2	17.2	2.23	11.7	9.3ab	7.80b	8.55b	448ab	458b	453b
$D_4 \times S_3$	19.0	6.73	17.3	2.13	11.7	9.lab	7.61b	8.36b	362d	450b	406bc
F test	ns	ns	ns	ns	ns	*	*	*	**	*	**
CV (%)	6.45	5.41	7.81	5.47	9.57	7.41	9.68	8.54	6.93	11.87	9.40

Means having same letter (s) or without letter are not significantly different by DMRT
'ns' means insignificant, * significant at *5%* and **significant at 1% probability level.

Table 2b. Interaction effect of seed rate and line spacing on yield and profitability of Bilatidhonia.

Interaction	Yield (t/ha)			Gross return (Tk. Thousand/ha)			Var. cost	Total cost	Gross margin (Tk. Thousand/ha)			Benefit cost ratio		
	03-04	04-05	Pooled	03-04	04-05	Pooled			03-04	04-05	Pooled	03-04	04-05	Pooled
$D_1 \times S_1$	29.34c-f	32.60c	30.97c	6,45.5bc	7,17.2cd	6,81.3cd	1,33.5	1,51.5	5,l2.0bc	5,83.7de	5,47.8d	4.26ab	4.73bc	4.50ab
$D_1 \times S_2$	34.l2bc	46.6lab	40.37ab	7,50.6ab	10,25.4ab	8,88.0b	1,53.5	1,72.7	5,97.1b	8,71.9b	7,34.5b	4.35ab	5.94a	5.14a
$D_1 \times S_3$	40.00a	53.78a	46.89a	8,80.0a	11,83.2a	10,31.6a	1,73.5	1,93.9	7,06.5a	10,09.7a	8,58.1a	4.54a	6.10a	5.32a
$D_2 \times S_1$	30.92b-e	33.23bc	32.08bc	6,80.2b	7,3l.lcd	7,05.7cd	1,33.5	1,51.5	5,46.7bc	5,97.6de	5,72.2cd	4.49a	4.83bc	4.66ab
$D_2 \times S_2$	32.52bcd	44.90ab	38.71b	7,15.4b	9,87.8b	8,51.6bc	1,53.5	1,72.7	5,61.9b	8,34.3bc	6,98.1bc	4.14b	5.72a	4.93a
$D_2 \times S_3$	36.40ab	49.50a	42.95ab	8,00.8a	10,89.0a	9,44.9ab	1,73.5	1,93.9	6,27.3ab	9,15.5ab	7,71.4ab	4.13b	5.62ab	4.87ab
$D_3 \times S_1$	24.80f	30.86cd	27.83d	5,45.6d	6,78.9d	6,12.3d	1,33.5	1,51.5	4,l2.lcd	5,45.4e	4,78.8d	3.60c	4.48bc	4.04b
$D_3 \times S_2$	28.52c-f	41.0b	34.76bc	6,27.4c	9,02.0bc	7,64.7c	1,53.5	1,72.7	4,73.9c	7,48.5cd	6,11.2c	3.63c	5.22b	4.43b
$D_3 \times S_3$	28.26c-f	43.l3ab	35.70bc	6,21.7c	9,48.9b	7,85.3c	1,73.5	1,93.9	4,48.2c	7,75.4c	6,11.8c	3.2lcd	4.89bc	4.05b
$D_4 \times S_1$	28.26def	29.57d	28.92cd	6,21.7c	6,50.5d	6,36.1d	1,33.5	1,51.5	4,88.2c	5,17.0e	5,02.bd	4.10b	4.29c	4.28b
$D_4 \times S_2$	31.46bcd	34.64bc	33.05bc	6,92.1b	7,62.1c	7,27.1cd	1,53.5	1,72.7	5,38.6bc	6,08.6d	5,73.6cd	4.0lbc	4.41c	4.21b
$D_4 \times S_3$	25.46ef	34.llbc	29.79c	5,60.1d	7,50.4c	6,55.3d	1,73.5	1,93.9	3,86.6d	5,76.9de	4.81.8d	2.89d	3.87c	3.38c
F test	**	**	**	*	**	**	--	--	*	**	*	**	**	**
CV (%)	7.11	11.23	9.17	9.61	11.30	10.46	--	--	8.62	10.63	9.63	8.72	10.23	9.48

Means having same letter (s) or without letter are not significantly different by DMRT

'ns' means insignificant, * significant at 5% and **' significant at 1% probability level.

Market value: Fresh Bilatidhonia (Tk. 22/kg), urea (Tk. 6.50/kg), TSP (Tk. 18.00/kg), MP ((Tk. 17.00/1kg) cowdung (Tk. 0.50/kg), seed (Tk. 2000.00/kg), land fare (Tk. 10000/-/ha/6 months), interest on capital (6.0% of variable cost/6 month) and laborer (Tk. 120.00/man-day).

some of the plants at later stage that hampered last two harvests and reduced the number of plants as well as fresh yield. One an average, maximum fresh yield (46.89 t/ha) was obtained from the treatment combination ($D_1 \times S_3$), which was statistically identical with the treatment combinations $D_2 \times S_3$ (42.95 t/ha) and $D_1 \times S_2$ (40.37 t/ha). All the three combinations gave higher yield due to higher number of plants/m^2 (Table 2.b) The lowest fresh yield was recorded from $D_3 \times S_1$ (27.83 t/ha) due to lower number of plants/m^2.

Economic performances: Interaction between seed rate and method of sowing showed significant variation in gross margin, net margin and BCR (Table 2.b). The maximum gross return (Tk. 10,31.6 thousand/ha) and gross margin (Tk. 858.l thousand/ha) were obtained from the treatment combination $D_1 \times S_3$ which was statistically similar with $D_2 x S_3$. The lowest gross return (Tk. 655.3 thousand/ha) and margin (Tk. 481.8 thousand/ha) obtained from $D_4 \times S_3$ treatment combination. The highest BCR (5.95) was obtained from the treatment combination $D_1 \times S_3$, which was statistically similar with $D_1 \times S_1$, $D_1 \times S_2$, $D_2 \times S_1$, $D_2 \times S_2$, and $D_2 \times S_3$ treatment combinations. The lowest BCR (3.78) was found from the wider spacing with highest seed rate ($D_4 \times S_3$) which might be due to lower yield as well as higher seed cost that increased variable cost. In closer spacing or broadcast method of sowing with moderate seed rate provided higher yield that ensured maximum profit.

From the investigation, it was revealed that broadcast method of sowing with 30 to 40 kg/ha seed rate (depending on the period of harvest, fertility, and type of soil) were suitable for Bilatidhonia cultivation, but closer spacing (10 cm) could be advocated for easy cultivation process.

References

Anonymous.2008. http//www.uni-graz.atl--katzer/engl/corilsat.html Viewed 15.08/2008.

Islam, M. R., S. N. Mozumder, M. Moniruzzaman and S. N. Alam. 2003. Effect of N, P, and K on yield and profitability of Bilatidhonia *(Eiyngium foetidum* L.) cultivation in the hilly region. *Bangladesh J. Agril. Res*. **28**(1): 105-110.

Moniruzzaman, M. 2002. Effect of light intensity and nitrogen on the yield and quality of Bangladhonia *(Eryngium foetidum* L.). M.S. Thesis, Bangabandhu Sheikh Mijibur Rahman Agricultural University, Salna, Gazipur. 1706.

Moniruzzaman, M., S. M. M. Rahman and S. N. Mozumder. 2000. Effect of seed rate and shade on false coriander *(Eiyngium foetidum* L.) production in the hilly area. *Bangladesh Hort.* **28**(1&2): 34-38.

Mozumder, S. N., N. Sultana, M. M. Hossain, J. U. Ahmed and A. A. Khan. 2007. Effect of growth regulators and seed rate on seed germination and biomass production of Bangladhonia *(Eryngium foetidium* L). *J. Life Sci.* **19**(2): 91-96.

Zaman, S. M. H., K. Rahim and M. Hawlader 1987. Simple Lessons from Biometry. Bangladesh Rice Research Instititute, Gazipur. Pp. 29-34.