

Seed Yield Response of Berseem (*Trifolium alexandrinum* L.) to Foliage Applied Gibberellic Acid and Mineral Nutrients

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ABSTRACT A field experiment was conducted during *rabi* seasons of 1998-99 and 1999-2000 at the Central Research Farm of the Indian Grassland and Fodder Research Institute, Jhansi, to compare the relative effectiveness of foliage applied gibberellic acid and mineral nutrients on the seed yield and its attributes in berseem. Foliar spray of tresol @2.5 l/ha or gibberellic acid (GA) @ 50 ppm proved effective in improving the seed yield of berseem. Higher concentration of gibberellic acid (150 ppm) depressed the seed yield markedly.

Keywords: Berseem, *Trifolium alexandrinum* L., seed yield, gibberellic acid, mineral nutrients

Berseem (*Trifolium alexandrinum* L.) is the most important winter fodder crop of India. It is an annual leguminous forage species, and occupies maximum area among forage crops grown during winter season [1]. The seed productivity of this crop is generally low in most of the berseem-growing tracts of the country, causing shortage of seed. Main reason for the deficit of the quality seed is the preference of farmers for green fodder and they do not pay much attention to produce good quality seed [2]. Generally, the fodder cuttings are continued till late March or mid April, which results in low seed productivity. However, the seed yield of berseem could be enhanced through proper cutting management, optimum irrigation scheduling after last fodder cut and of course, by foliar application of growth hormones and mineral nutrients.

The foliar application of growth hormones has resulted in a significant increase in berseem seed yield [3, 4]. Similarly, foliar application of different mineral nutrients increase the seed yield of various forage crops [5]. While in most of the previous studies the use of growth hormones and mineral nutrients were studied separately, and no attempt was made to compare them in one experiment. Thus, keeping the above facts in view, the present investigation was carried out to compare the relative

efficacy of foliage applied growth hormones and mineral nutrients on seed yield and its attributes in berseem. Further aim was to assess the impact of various treatments on seed recovery, i.e. harvest index, biological and straw yields.

MATERIALS AND METHODS

Field experiments were conducted during *rabi* seasons of 1998-99 and 1999-2000 at the Central Research Farm of the Indian Grassland and Fodder Research Institute, Jhansi (25° 7' N, 78° 35' E; 275 m above mean sea level). The soil of the experimental site was slightly alkaline in reaction (pH 7.6), medium textured, containing 0.06% total N and 8.8 kg/ha available P. Seven treatments i.e. tresol @ 1.5 l/ha, 2.5 l/ha, 3.5 l/ha, gibberellic acid (GA) @ 50ppm, 100 ppm, 150 ppm and control (water spray), were allocated in a randomized block design with 4 replications. Tresol is a mixture of micro nutrients and gibberellic acid in chelated form. Foliar spray of tresol and growth hormones, at requisite concentration or as per treatment, was done @ 800 l/ha solution during early flowering stage in both the years. The seed of variety 'Wardan' @ 25 kg/ha was sown in rows 25 cm apart. Sowing of the seed was done under dry condition in furrows, and a light irrigation was provided immediately after the

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sowing. The size of the individual plot was 4 m x 3 m. However, a net plot area of 3 m x 2.5 m was harvested for recording the seed, straw and biological yields. Sowing of the crop was done on October 24 and November 5 during 1998 and 1999, respectively. The corresponding dates of seed harvests were May 6, 1999 and May 10, 2000. A uniform basal dose of 20 kg N and 40 kg P₂O₅/ha, in the form of urea and single superphosphate, respectively, was applied in furrows. Spraying of tresol and GA was done during early flowering stage. All the necessary observations like biological yield, straw yield, seed yield and its attributes were recorded at harvest. The harvest index was computed by dividing the seed yield by biological yield (seed + straw yield). In total, 3 cuttings of the crop were taken for green fodder and then the crop was left for seed production after the 3rd cutting in first week of March every year. The statistical analysis of the data was done using MSTAT-C software.

RESULTS AND DISCUSSION

Seed yield attributes:

Foliar spraying of different concentrations of tresol and gibberellic acid (GA) influenced the seed yield attributes significantly, except the head density, in this experiment (Table 1). Head density remained unaffected significantly as the treatments were imposed after the emergence of the flowers. Spraying of tresol @ 2.5 l/ha recorded maximum number of seeds per head, being at par to GA @ 50 ppm and significantly greater to all the other treatments during both the years of experimentation. Similarly, 1000-seed weight was maximum in tresol @ 2.5 l/ha, being at par to GA @ 50 ppm and GA @ 100 ppm, significantly higher to rest of the treatments during year 1. However, in year 2, the highest 1000-seed weight was obtained at tresol 2.5 l/ha, being at par to GA @ 50 ppm, but significantly higher to GA @ 100 ppm. The lowest values of seeds/ head and 1000-seed weight were recorded in control (water spray) during both the years of experimentation. In general, the increased concentrations of GA reduced the number of seeds/ flower head and 1000-seed weight. As the tresol contained all the seven micro nutrients essential for plant growth and development in chelated form, it encouraged the fertilization, seed setting and seed development positively. For example, boron probably plays a role in pollen tube elongation [6] which is essential for fertilization and seed set. In the literature, variations in seed weight have been observed with the use of growth regulators but the

effects are often inconsistent in forage legumes. Paclobutrazol, a growth regulator, increased seed weight in some studies [7] but reduced it in others [8].

Seed yield:

Seed yield of berseem was influenced significantly by different concentrations of gibberellic acid (GA) and tresol during both the years of experimentation (Table 2). The highest seed yield was recorded from tresol @ 2.5 l/ha, being at par to GA @ 50 ppm and significantly higher to the rest of the foliar spray treatments in both the years of study. The increase in seed yield by foliar spray of tresol @ 2.5 l/ha resulted mainly through the increased number of seeds/head and 1000-seed weight as evidenced in Table 1. Statistically, similar seed yields were obtained at GA @ 50 ppm, 100 ppm and tresol @ 1.5 l/ha in year 1. However, GA @ 50 ppm produced significantly higher quantity of seed over GA @ 100 or 150 ppm during year 2. In general, the increasing levels of gibberellic acid beyond 50 ppm depressed the seed yield severely as compared to the increasing levels of tresol to 3.5 l/ha. Even, application of GA @ 150 ppm recorded at par seed yield to control in either of the years of experimentation. Yadava *et al.* [9] have also reported the increase in seed yield of berseem through the application of growth hormones at a specified concentration.

Biological yield, straw yield and harvest index:

The biological and straw yields were not affected significantly by various treatments in both the years of study (Table 2). Obviously, the foliar spray of GA and tresol for various treatments was done at early flowering stage and by this time the crop had already attained the maximum vegetative growth, hence, it could not influence the biological and straw yields significantly. But the foliar sprays of GA and tresol at varying concentrations exhibited a significant and profound effect on the recovery of seed, i.e. harvest index, in both the years. The highest value of harvest index was recorded for tresol @ 2.5 l/ha, being significantly greater to all the other treatments during both the years. The increased (highest) level of GA to 150 ppm recorded at par harvest index to control. A significant reduction in number of seeds/ flower head and 1000-seed weight caused the decline in harvest index at GA 150 ppm.

Foliar spray of a chelated solution of micronutrients and gibberellic acid @ 2.5 l/ha and gibberellic acid (GA) @ 50 ppm both proved effective in improving seed yield of berseem. Considering the cost involved, chelated solution of micronutrients

Table 1. Effect of foliage applied gibberellic acid and mineral nutrients on seed yield attributes of berseem (*Trifolium alexandrinum* L.) at harvest

Treatment	Head density/m ²		No. of seeds/flower head		1000-seed weight (g)	
	1998-99	1999-00	1998-99	1999-00	1998-99	1999-00
Tresol @1.5 l/ha	524	580	43	52	2.84	3.21
Tresol @ 2.5 l/ha	584	600	51	58	2.94	3.60
Tresol @3.5 l/ha	545	630	41	51	2.76	3.17
GA @ 50 ppm	560	565	45	53	2.88	3.42
GA @ 100 ppm	536	595	42	50	2.87	3.33
GA @ 150 ppm	552	610	39	44	2.83	3.17
Control	538	585	36	43	2.74	3.04
CD (P=0.05)	NS	NS	7.0	5.4	0.13	0.22

NS: Not significant

Table 2. Effect of foliage applied gibberellic acid and mineral nutrients on biological, seed and straw yields, and harvest index of berseem (*Trifolium alexandrinum* L.)

Treatment	Biological yield (q/ha)		Seed Yield (kg/ha)		Straw yield (q/ha)		Harvest index	
	1998-99	1999-00	1998-99	1999-00	1998-99	1999-00	1998-99	1999-00
Tresol @ 1.5 l/ha	34.4	35.9	418	462	30.2	31.3	0.12	0.13
Tresol @ 2.5 l/ha	36.1	37.4	539	576	30.7	31.6	0.15	0.15
Tresol @ 3.5 l/ha	35.5	36.7	426	485	31.1	31.7	0.12	0.13
GA @ 50 ppm	35.0	36.0	441	500	30.8	31.2	0.12	0.13
GA @ 100 ppm	35.1	36.2	414	389	31.0	32.3	0.12	0.11
GA @ 150 ppm	34.7	36.7	329	362	31.4	33.1	0.09	0.10
Control	33.2	34.9	312	308	30.1	31.8	0.09	0.09
CD (P=0.05)	NS	NS	105	79	NS	NS	0.01	0.02

NS: Not significant

and gibberellic acid @ 2.5 l/ha is recommended for enhancing the seed yield of berseem.

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