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RESEARCH PAPER

Influence of sowing time and seed rate on seed quality of sunn hemp (*Crotalaria juncea* L.)

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Abstract: A laboratory experiment was conducted at the department of Seed Science and Technology, University of Agricultural Sciences, Raichur during *rabi* 2024 to optimize the sowing time and seed rate on seed quality of sunn hemp. The experiment consists of twenty treatments *i.e.*, five sowing dates (1st week of September, 3rd week of September, 1st week of October, 3rd week of October and 1st week of November) and four seed rates (15, 20, 25 and 30 kg per hectare) in FCRD with four replications. The results revealed that significantly highest seed germination (85.94%), shoot length (13.10 cm), root length (13.88 cm) and seedling vigour index I (2319) and numerically highest seedling dry weight (17.94 mg) and seedling vigour index II (1542) was recorded in sowing sunn hemp in 3rd week of September (D_2). While, the 1st week of November (D_5) sowing has recorded the lowest values for all the parameters. Among the different seed rates used, the seed rate of 15 kg per ha has recorded numerically higher seed germination (83.64%), shoot length (12.71 cm), root length (11.60 cm) seedling dry weight (18.03 mg) and seedling vigour index I and II (2039 and 1509, respectively). Hence, for sunn hemp seed production sowing can be taken up from 3rd week of September (D_2) to 1st week of October (D_3) with a seed rate of 15 kg per hectare was found to be superior from the above study

Key words: Seed rates, Seed germination, Sowing dates

Introduction

Green manuring is an age old practice of farming for maintaining soil fertility. The green revolution, however, has minimized the use of green manures in intensive cropping systems while simultaneously increasing the demand for chemical fertilizers. India has transitioned from a food-scarce region to one with food security by using more chemical fertilizers which are available at subsidized rates, due to which the use of organic manures, such as green manure crops, has significantly decreased. Continuous use of these chemical fertilizers has resulted in low soil fertility. Further, due to farm mechanisation the cattle and bull population has also reduced over the years. Similarly, the cow and buffalo population in the villages have also minimised in the last one decade due to less interest by the young generation in the villages towards agriculture and its allied sector. These all are the major sources of cow dung and farm yard manure which were the major source of organic fertilizers since long time. The loss of soil fertility due to the use of chemical fertilizer and also due to non availability of FYM there is a need to go for other source of organic manure like green manure crops. Green manure crops are an inexpensive and efficient way to reduce the need for inorganic fertilizers while preserving the fertility and soil health status. The majority of green manure crops that are incorporated either in-situ or ex-situ includes all of the plant nutrients needed to support soil health and improve crop growth.

Sunn hemp (*Crotalaria juncea* L.) is a tropical Asian plant that belongs to the family Leguminosae. It is generally considered to have been originated in India (Montgomery, 1954). The genus '*Crotalaria*' means rattle and is indicative of the noise made by the seeds when shaken in the matured pods (White and Huan, 1965). Sunn hemp is an N-fixing legume and also a soil improver. It can fix around 50-60 kg per ha N to the soil within 60-90 days (Sarkar *et al*., 2015) when it is used as green manure. It has the potential to improve soil properties, build up organic matter and sequester carbon in the soil and also for soil reclamation.

The non-availability of good quality seed is one of the handicaps in popularising sunn hemp as a green manure crop. Hence, quality seed production and its availability at reasonable price is the need of the hour. For seed production of this crop, suitable techniques need to be developed for each agro-climatic situation. Among the different agronomic practices of growing sunn hemp for seed, date of sowing and seed rate are considered as the most important ones for increasing the productivity and quality of seed. The suitable time of sowing is most important from the point of obtaining high yield as it provides optimum growing conditions such as temperature, light, humidity and rainfall. The growth phases of the crop should be synchronised with optimum environmental conditions for better expression of growth and yield. Apart from this, sunn hemp crop is known to vary its vegetative and reproductive growth periods with the climatic conditions. Hence, fixing the date of sowing and proper seed rate for seed production purpose is most important and critical for seed production. Hence the present experiment was planned.

Material and methods

The experiment entitled "Influence of sowing time and seed rate on seed quality of sunn hemp (*Crotalaria juncea* L.)" was conducted at Seed Quality Assurance and Research Laboratory,

Seed Unit, University of Agricultural Sciences, Raichur, Karnataka during *rabi*, 2023-24. The experiment consisted of five different sowing dates and four seed rates and treatments were evaluated under factorial completely randomized design with four replications. Factor I comprised of five sowing dates *viz*., 1st week of September, 3rd week of September, 1st week of October, 3rd week of October and 1st week of November. Factor II was seed rates *viz*., 15, 20, 25 and 30 kg per hectare. The crop was harvested when it reached physiological maturity, and seed from all the treatments under this investigation was collected separately. The seeds obtained from field experiment was used to assess the seed quality parameters.

The observations were recorded for seed germination (%), shoot and root length (cm), seedling dry weight (mg), seedling vigour index-I and seedling vigour index-II. Germination test was conducted as per (Anon., 2014) using between paper method, the germinated seedlings were evaluated on 4th and 10th days after incubation. Seedling vigour index-I and seedling vigour index-II was calculated as per the formula given by Abdul-Baki and Anderson (1973) and expressed in whole number.

SVI-I = Germination (%) × Seedling length (cm)

SVI-II = Germination (%) × Seedling dry weight (mg)

The data obtained were statistically analysed using the methodology outlined by Panse and Sukhatme (1978).

Results and discussion

Results computed in Table 1 clearly indicated the effect of sowing time and seed rate on seed quality of sunn hemp. Among the different sowing dates under the study, the D_2 (3rd week of September) date of sowing has recorded significantly highest seed germination (85.94 %) (Fig. 1), root (13.88 cm) and shoot (13.10 cm) length which was on par with D_3 (1st week of October - 84.64 % and 13.12 cm) for seed germination and root length and on par with D_3 (1st week of October 12.63 cm), D_1 (1st week of September 12.32 cm) and D_4 (3rd week of October 11.95 cm) for shoot length. While, the lowest seed germination (81.41%), root length (9.08 cm) and shoot length (11.54 cm) was recorded in the resultant seeds which were harvested from the crop that

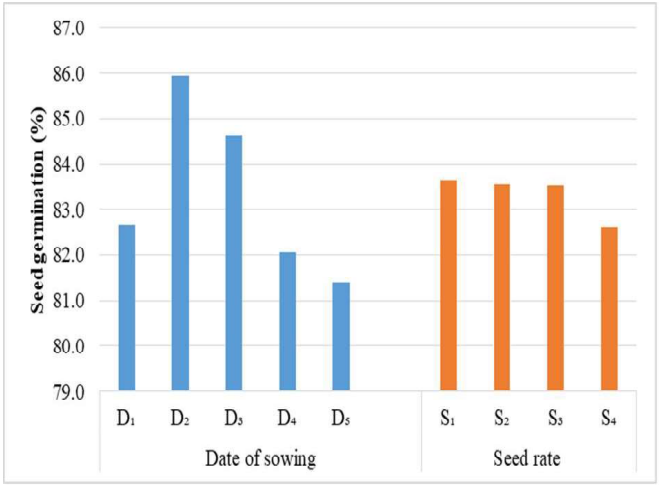

Fig1. Seed germination of sunn hemp as influenced by sowing time and seed rate

Legend

Date of sowing (D): D_1: 1st week of September D_2: 3rd week of September D_3: 1st week of October D_4: 3rd week of October D_5: 1st week of November

Seed rate (S): S_1: 15 kg/ha S_2: 20 kg/ha S_3: 25 kg/ha S_4: 30 kg/ha

was sown on D_5 (1st week of November). This might be due to better seed filling in early sowing that resulted into higher test weight. The bolder seeds with high food reserves might have supplied sufficient food reserves for better seed germination there by higher root and shoot length (Tiparaddi *et al*., 2006). The results are in agreement with Yadav and Nagarjun (1995) in green gram and Sharma (2021) in fenugreek. Similarly, significantly highest seedling vigour index-I (2319) (Fig. 2) was also recorded in 3rd week of September sowing which was on par with D_3 (1st week of October-2181). While, the lowest seedling vigour index-I (1678) was recorded in D_5 (1st week of November). This may be due to higher seed germination and better root and shoot length in the seeds obtained from 3rd week of September (D_2) sowing due to accumulation of more food reserves in the seeds. As the sowing was delayed, the seed germination and seedling length were reduced, this had led to

Table 1. Seed quality parameters of sunn hemp as influenced by sowing time and seed rates.

Treatments	Seed germination (%)	Root length (cm)	Shoot length (cm)	Seedling dry weight (mg)	Seedling vigour index-I	Seedling vigour index-II
			Date of sowing			
D_1-1st week of September	82.67	11.55	12.32	17.57	1974	1452
D_2-3rd week of September	85.94	13.88	13.10	17.94	2319	1542
D_3-1st week of October	84.64	13.12	12.63	17.88	2181	1514
D_4-3rd week of October	82.05	9.28	11.95	17.34	1742	1423
D_5-1st week of November	81.41	9.08	11.54	17.20	1678	1400
S.Em±	0.35	0.39	0.29	0.54	48	47
C.D @ 1%	1.36	1.50	1.22	NS	174	NS
			Seed rate			
S_1-15 kg/ha	83.64	11.60	12.71	18.03	2039	1509
S_2-20 kg/ha	83.57	11.50	12.60	18.02	2017	1507
S_3-25 kg/ha	83.54	11.23	12.09	17.22	1954	1439
S_4-30 kg/ha	82.61	11.19	11.84	17.08	1905	1410
S.Em±	0.32	0.35	0.26	0.48	43	42
C.D @ 1%	NS	NS	NS	NS	NS	NS

Table 2. Seed quality parameters of sunn hemp as influenced by interaction between sowing time and seed rates.

Treatments	Seed germination(%)	Root length (cm)	Shoot length (cm)	Seedling dry weight (mg)	Seedling vigour index-I	Seedling vigour index-II
Interactions (D x S)						
D_1S_1	83.67	12.46	13.33	17.08	2158	1429
D_1S_2	82.59	11.49	12.98	18.26	2021	1508
D_1S_3	82.48	10.90	11.29	17.10	1830	1410
D_1S_4	81.94	11.34	11.68	17.82	1886	1460
D_2S_1	86.74	15.31	13.23	19.57	2476	1698
D_2S_2	85.35	13.57	12.96	18.04	2264	1540
D_2S_3	86.02	13.35	12.56	17.65	2229	1518
D_2S_4	85.64	13.27	13.66	16.51	2306	1414
D_3S_1	84.40	12.61	12.72	18.26	2138	1541
D_3S_2	86.09	13.80	13.14	18.96	2319	1632
D_3S_3	86.09	14.73	12.14	17.80	2313	1532
D_3S_4	81.99	11.33	12.51	16.49	1955	1352
D_4S_1	81.46	9.17	12.33	18.15	1751	1479
D_4S_2	82.77	9.05	11.86	18.11	1731	1499
D_4S_3	82.31	9.18	13.00	17.29	1826	1423
D_4S_4	81.65	9.72	10.60	15.82	1659	1292
D_5S_1	81.93	8.46	11.93	17.09	1671	1400
D_5S_2	81.05	9.57	12.03	16.71	1751	1354
D_5S_3	80.82	8.00	11.44	16.26	1571	1314
D_5S_4	81.82	10.29	10.75	18.74	1721	1533
S.Em±	0.71	0.78	0.59	1.08	96	93
C.D@ 1%	NS	NS	NS	NS	NS	NS

Legend

Date of sowing (D): D_1: 1st week of September D_2: 3rd week of September D_3: 1st week of October D_4: 3rd week of October D_5: 1st week of November Seed rate (S): S_1: 15 kg/ha S_2: 20 kg/ha S_3: 25 kg/ha S_4: 30 kg/ha

reduced seedling vigour index - I when the sowing was delayed. While, the 3rd week of September (D_2) sowing, had recorded numerically highest seedling dry weight (18.03 mg) and seedling vigour index-II (1542) (Table 5). This was mainly due to higher seed germination and seedling dry weight that were recorded in 3rd week of September (D_2) sowing due to proper accumulation of food reserves in the seeds. The results are in confirmation with the findings of Yadav and Nagarjun (1995) in greengram and Sharma (2021) in fenugreek.

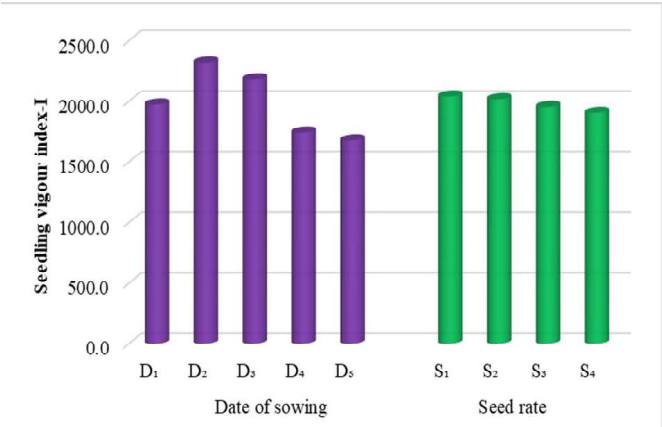

Fig. 2. Seedling vigour index-I of sunn hemp as influenced by sowing time and seed rate

Legend

Date of sowing (D): D_1: 1st week of September D_2: 3rd week of September D_3: 1st week of October D_4: 3rd week of October D_5: 1st week of November Seed rate (S) : S_1: 15 kg/ha S_2: 20 kg/ha S_3: 25 kg/ha S_4: 30 kg/ha

The seed rate had showed a non-significant difference (Table 1) for seed quality parameters though it recorded numerically highest seed germination (83.64 %), root (11.60 cm) and shoot (12.71 cm) length and seedling dry weight (18.03 mg) in S_1 (15 kg/ha). The results are in agreement with the findings of Vats (2011) who reported that seed quality parameters such as seed germination, root and shoot length and seedling dry weight decreases with an increase in seed rate. This might be due to better availability of nutrients at lower seed rate which leads to increase in seedling length of plant with decrease in seed rate in fenugreek. These findings are in line with Tiparaddi *et al*. (2006) and Thimmanna *et al*. (2014) in sunn hemp, Sangeetha *et al*. (2011) in dhaincha. Similarly, the S_1 (15 kg/ha) seed rate had recorded numerically highest seedling vigour index-I (2039) and II (1509).In the same line Sangeetha *et al*. (2011) noticed significantly higher seed quality parameters *viz*., germination percentage, seedling length and seedling vigour index at lower plant population compared to higher plant population in dhaincha. These findings are in line with Parlawar *et al*. (2005) and Thimmanna *et al*. (2014) in sunn hemp.

It was found that there was a non-significant difference for the interaction of dates of sowing and seed rate for all the seed quality parameters (Table 2).

Conclusion

Among the different sowing dates, the 3rd week of September (D_2) sowing had recorded significantly highest seed quality parameters and it was on par with 1st week of October (D_3) sowing. As the sowing was delayed, the seed quality parameters

were reduced drastically. Among the different seed rates, no significant difference were noticed for seed quality parameters. Hence, Sunn hemp sowing can be taken from 3rd week of September (D_2) to 1st week of October (D_3) with the seed rate of 15 kg per ha for seed production in order to harvest better quality seed in North eastern dry zone of Karnataka.

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