



Evaluation of sunnhemp (*Crotalaria juncea*) genotypes for high fibre yield

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ABSTRACT

Four genetically different genotypes of sunnhemp (*Crotalaria juncea* L.) were evaluated for fibre yield and its yield component traits for three years 2008-2009 to 2010-2011 at Sunnhemp Research Station, Pratapgarh, Uttar Pradesh. Significant differences among experimental genotypes were recorded for fibre yield and its attributes. High fibre yield/ha was recorded for SUIN-029 (9.06 q/ha) followed by SUIN-80 (8.94 q/ha). The highest green biomass yield (337.30 q/ha) and stick yield (52.41 q/ha) were recorded for SUIN-029. The analysis of the data for all years revealed superiority of genotype SUIN-029 for most of the fibre yield traits. This genotype can be used as donor for future breeding programme.

Key words: Fibre yield, Genetic improvement, Harvest index, Sunnhemp

Sunnhemp (*Crotalaria juncea* L.) is an important source of natural fibre. It is used for preparation of cordage, fishing nets, tatpattis, ropes, twines, canvas and floor mats etc. It is also used for making specialty paper like currency notes, fine quality cigarette paper, tissue paper, sunmica base papers, carbon base paper, wax impregnated paper, electrical condenser, airmail paper and handmade paper etc. (Pradhan *et al.* 1999, Tripathi *et al.* 2012). For certain fiber properties, sunnhemp is superior to kenaf (*Hibiscus cannabinus* L.) as a fiber crop. It is also superior because of its resistance to root-knot nematodes [*Meloidogyne incognita* (Koford & White) Chitwood] and has the advantage of being a soil-improving crop via nitrogen fixation (Dempsey 1975). It is one of the most outstanding green manure crops suited to almost all parts of the country (Ram and Singh 2011). The sticks of sunnhemp are used for staking beetle vines in many parts of India (especially in Bundelkhand, Eastern Uttar Pradesh and West Bengal) and as well as a good source of fuel.

The area under sunnhemp cultivation in India has declined from about 2 lakh hectares in 1950's to merely 31 500 hectares in 2007-08. Its production and productivity have plateaued and was 18 800 tonnes and 597 kg/ha, respectively during 2011-12. It has lost its importance in

earning foreign exchange because of low production. Despite having many valuable uses, acreage under this crop has drastically reduced in past decades. The unavailability of good quality seeds is one of the important reasons for reduced popularity of sunnhemp (Chittapur and Kulkarni 2003).

In sunnhemp, varietal development is very difficult task because it is highly cross pollinated crop. The first variety in sunnhemp K 12 black was released in 1926 by Prof T Subbnis. Research on genetic improvement of sunnhemp in India is being carried out at Sunnhemp Research Station, Pratapgarh (Uttar Pradesh) under ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore (West Bengal). In the past, the Research Station has developed four varieties namely, K 12 Yellow, SH 4 (Shailesh), Swastik and Ankur. K 12 Yellow is a selection from variety K 12 Black. The varieties Shailesh (2005), Swastik (2009) and Ankur (2013) have been developed/bred through mass selection. The recently released variety Ankur produces about 10-12 q/ha fibre with good combination of fibre tenacity (21.0 g/tex).

Sunnhemp has been losing its importance as a fibre crop which due to lack of stable high yielding varieties and popularization of existing varieties among the farmers. Hence, there is an urgent need for development of improved varieties of sunnhemp for maximizing yield.

MATERIALS AND METHODS

Four sunnhemp genotypes namely SUIN 080, SUIN 043, SUIN 037 and SUIN 029 were evaluated against two national check varieties K 12 Yellow and SH 4. The experiments were conducted at experimental farm of

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Sunnhemp Research Station (CRIJAF), Pratapgarh, Uttar Pradesh, India during the year 2008-2009, 2009-2010 and 2010-2011 in the summer season. The Research Station is located at latitude of 25°34'N and longitude of 81°19' E and at an altitude of 137m above sea level. The soil of experimental field is sandy loam in texture. The soil reaction is slightly alkaline with pH 7.6. The experiment was initiated in the second fortnight of April under irrigated condition in Randomized Block Design (RBD) with six replications. Seed rate was 25 kg/ha and fertilizers were applied at the rate of 20 kg/ha P and 20 kg/ha K at the time of sowing. Urea was not applied in the experiment. The inter-row and intra-row spacing was kept at 25 cm and 5-7cm, respectively. Each genotype was grown in 20 row plots having row length of 4.5m. Crop was kept free from weed up to 45 days after date sowing through manual weeding. Two to three irrigations were applied at 15 to 25 days interval. The crop was harvested in 90-100 days. Data on important characters like plant height (cm), basal diameter (mm), green biomass yield (q/ha), fibre yield (q/ha) and stick weight (q/ha) were recorded. The statistical analysis was carried out using OPSTAT. HAU, Hisar. The harvest index for fibre yield was worked out as follows:

$$\text{Harvest index for fibre yield} = \frac{\text{Weight of fibre yield} \times 100}{\text{Total biomass yield}}$$

RESULTS AND DISCUSSION

Statistical analysis of data for the year 2008-09 showed non significant differences among genotypes for all characters like plant height, basal diameter, green biomass yield, fibre yield and stick yield (Table 1). Maximum plant height (240.53 cm) was recorded by the genotype SUIN 043 followed by the check variety K 12 yellow (236.67 cm). The genotype SUIN-037 recorded the least plant height (230.70 cm). The maximum basal diameter (10.65 cm) was recorded for SUIN 043 which was lower than both check varieties with basal diameter 10.77 mm and 10.75 mm for K 12 yellow and SH 4, respectively. Lowest value for basal

Table 1 Data of fibre yield and yield component during the year 2008-2009 at SHRS, Pratapgarh, Uttar Pradesh

Genotype	Plant height (cm)	Basal diameter (mm)	Green weight (q/ha)	Fibre yield (q/ha)	Stick weight (q/ha)
	Mean	Mean	Mean	Mean	Mean
SUIN 080	232.80	10.40	392.59	11.13	61.78
SUIN 037	230.70	10.45	355.55	10.26	57.08
SUIN 043	240.53	10.65	357.40	10.20	55.55
SUIN 029	230.73	10.43	390.74	10.53	59.53
K 12 Yellow (C)	236.67	10.77	396.30	10.47	66.76
SH 4 (C)	231.00	10.75	385.19	10.78	53.62
CD					
SE(m)	5.26	0.40	22.85	0.60	4.07
SE(d)	7.44	0.57	32.31	0.84	5.76
CV	5.51	9.32	14.74	13.83	16.89

Table 2 Data of fibre yield and yield component during the year 2009-2010 at SHRS, Pratapgarh, Uttar Pradesh

Genotype	Plant height (cm)	Basal diameter (mm)	Green weight (q/ha)	Fibre yield (q/ha)	Stick weight (q/ha)
	Mean	Mean	Mean	Mean	Mean
SUIN 080	275.83	9.95	350.95	10.48	61.99
SUIN 037	270.90	9.67	359.05	10.50	64.56
SUIN 043	269.17	10.32	345.24	10.08	60.01
SUIN 029	281.40	8.52	363.34	10.99	69.36
K 12 Yellow (C)	249.13	10.38	298.57	7.04	46.68
SH 4 (C)	270.93	10.03	348.10	9.95	61.99
CD	12.34		23.85	0.91	5.79
SE(m)	4.21	0.65	8.14	0.31	1.98
SE(d)	5.96	0.92	11.51	0.44	2.79
CV	3.83	16.31	5.79	7.73	7.96

diameter (10.40 mm) was recorded for genotype SUIN 080. Highest green biomass yield (392.59 q/ha) was observed for genotype SUIN 080 after the check variety K 12 Yellow (396.30 q/ha). Similarly maximum stick weight of 61.78 q/ha was recorded for SUIN-080 after the check K 12 yellow (66.76 q/ha). The genotype SUIN 080 produced higher fibre yield of 11.13 q/ha than the both check varieties K 12 Yellow (10.47 q/ha) and SH-4 (10.78 q/ha), respectively. Similar study was conducted by Kumar *et al.* (2008) for plant height, green weight, fibre weight and stick weight with significant differences.

Harvest Index did not exhibit significant genotypic effect in the year 2008-09 (Table 5). However, the genotype SUIN 037 recorded maximum harvest index of 2.91% while the check K 12 Yellow recorded the least harvest index (2.63).

The results in the year 2009-2010 revealed significant differences among genotypes for all the traits with the exception of basal diameter. The genotype SUIN 029 showed maximum plant height (281.40 cm) followed by the genotype SUIN 080 (275.83 cm). All other genotypes were on par

Table 3 Data of fibre yield and yield component during the year 2010-2011 at SHRS, Pratapgarh, Uttar Pradesh

Genotype	Plant height (cm)	Basal diameter (mm)	Green weight (q/ha)	Fibre yield (q/ha)	Stick weight (q/ha)
	Mean	Mean	Mean	Mean	Mean
SUIN 080	208.73	9.25	233.58	5.22	25.63
SUIN 037	204.02	8.43	263.42	5.67	28.33
SUIN 043	226.07	8.90	275.58	6.36	31.78
SUIN 029	219.82	8.52	257.83	5.67	28.33
K 12 Yellow (C)	204.50	9.53	261.25	5.64	28.57
SH 4 (C)	218.73	9.72	269.87	5.96	29.79
CD	13.23				
SE(m)	4.52	0.46	11.01	0.28	1.41
SE(d)	6.39	0.65	15.56	0.40	1.99
CV	5.18	12.46	10.36	12.07	12.00

Table 4 Pooled data of fibre yield and yield component 2008-2011 at SHRS, Pratapgarh, Uttar Pradesh

Genotype	Plant height	Basal diameter	Green weight	Fibre yield	Stick weight
	(cm)	(mm)	(q/ha)	(q/ha)	(q/ha)
	Mean	Mean	Mean	Mean	Mean
SUIN 080	239.12	9.87	325.71	8.94	49.80
SUIN 037	235.20	9.52	326.00	8.81	49.99
SUIN 043	245.26	9.96	326.08	8.88	49.11
SUIN 029	243.98	9.16	337.30	9.06	52.41
K 12 Yellow (C)	230.10	10.23	318.71	7.72	47.33
SH 4 (C)	240.22	10.17	334.38	8.89	48.47
CD	8.27			0.72	
SE(m)	2.82	0.36	8.01	0.25	1.44
SE(d)	3.99	0.51	11.33	0.35	2.04
CV	2.90	9.06	5.98	6.93	7.14

with each other with the exception of check variety K 12 Yellow, which recorded minimum plant height of 249.13 cm.

The genotype SUIN 029 attained maximum green biomass of 363.34 q/ha and was on par with genotype SUIN 037, and genotype SUIN-080 in order. The check variety K 12 Yellow showed minimum green biomass yield of 298.57 q/ha and was significantly inferior to other genotypes. The genotype SUIN 029 and SUIN 037 recorded highest fibre yield of 10.97 q/ha and 10.50 q/ha followed by the genotype SUIN 080 (10.48 q/ha) while both the checks K 12 Yellow and SH 4 recorded lowest fibre yield of 7.04 q/ha and 9.95 q/ha, respectively; and both the checks were significantly inferior to all other genotypes. The genotype SUIN 029 recorded maximum stick yield of 69.36 q/ha followed by 64.56 q/ha for the genotype SUIN 037 and was on par with each other. While the check variety K12 Yellow was recorded least stick yield (46.68 q/ha).

The genotype SUIN 029 performed best in the year 2009-2010 with respect to almost all the traits like plant height (281.0 cm), green biomass yield (363.34 q/ha), fibre yield (10.99 q/ha) and stick yield (69.36 q/ha) with the

Table 5 Harvest index for fibre yield in the year 2008-2009, 2009-2010, 2010-2011 and pooled at SHRS, Pratapgarh, Uttar Pradesh

Genotype	Harvest index for fibre yield			
	2008-2009	2009-2010	2010-2011	Pooled
SUIN-080	2.84	3.01	2.24	2.74
SUIN-037	2.91	2.96	2.15	2.71
SUIN-043	2.89	2.96	2.30	2.74
SUIN-029	2.69	3.03	2.22	2.69
K 12 Yellow (C)	2.63	2.38	2.16	2.42
SH-4 (C)	2.81	2.88	2.21	2.67
CD		0.33		0.18
SE(m)	0.11	0.11	0.08	0.06
SE(d)	0.15	0.16	0.11	0.09
CV	9.46	9.60	8.79	5.51

exception of basal diameter (7.04 mm). Similarly, the check variety K 12 yellow performed poorly with respect to all the traits with the exception of basal diameter 10.38 mm (Table 2).

The result for the year 2010-11 revealed significant genotypic effect for the trait plant height. All other traits were not affected by genotypic effect (Table 3). Maximum plant height (226.07 cm) was recorded for the genotype SUIN 043 followed by the genotype SUIN 029 (219.82 cm). The genotype SUIN 037 showed minimum plant height (204.02 cm). The maximum green biomass yield (275.58 q/ha), stick weight (31.78 q/ha) and fibre yield (6.36 q/ha) were recorded for the genotype SUIN 043. In the year 2010-11, the genotypic effect was found to be non-significant (Table 5). The entry SUIN 043 recorded maximum harvest index (2.30%), while the entry SUIN 037 recorded least harvest index of 2.15%.

The pooled analysis for three years revealed significant genotypic effect on plant height and fibre weight (Table 4). The maximum plant height was attained by the genotype SUIN 043 and SUIN 029 with plant height of 245.26 cm and 243.98 cm, respectively; and the genotype SUIN 080 was recorded plant height 239.12 cm with no significant differences among all the genotypes. The highest basal diameter (9.96 mm) was recorded by the genotype SUIN 043. The genotype SUIN 029 recorded maximum green biomass yield (337.3 q/ha), maximum stick yield (52.41 q/ha) and maximum fibre yield (9.06 q/ha) on the pooled basis. The genotype SUIN 029 showed superiority for most of the traits for the year 2009-10 and pooled analysis.

From the result of harvest index in the year 2009-10, the genotypic effect was found to be significant. All the varieties with the exception of the check variety K 12 Yellow were on par with each other with the highest harvest index (3.027%) recorded by SUIN 029 followed by SUIN 080, SUIN 037 and SUIN 043 with harvest index 3.01%, 2.96% and 2.96% respectively.

On the pooled basis the analysis revealed significant genotypic effect (Table 5). The entry SUIN 080 was found to be the best with harvest index of 2.74%. All other genotypes were on par with each other with the exception of check variety K 12 Yellow, which was recorded the least harvest index of 2.42%. Similar findings were reported on harvest index for sunnhemp seed (Barua *et al.* 2009). In the study the effect of density on harvest index (%) was significant and greater at 15 plants/m² (20.0%) than 55 plants/m² (15.1%).

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