

Performance of Jobs Tears Lines (*Coix lacryma-jobi*) under Foot Hill Condition of Nagaland

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Abstract An exploration and collection of jobsteer germplasm was conducted in different district of Nagaland and a total of 10 accessions were collected, evaluated and conserved for documentation. The samples were in the form of jobsteer seeds with varying color and size. Keeping these in view, a field experiment was carried out during the pre-*kharif* season of 2015 to assess the best suitable high yielding

line of jobsteer to encourage and arouse the farmer's interest in its commercial cultivation under the foot hill condition of Nagaland. Experiment was laid out in completely randomized block design and replicated thrice. A total of 10 jobsteer germplasm viz. JBN-1, JBN-2, JBN-3, JBN-4, JBN-5, JBN-6, JBN-7, JBN-8, JBN-9 and JBN-10 were collected from the farmers' field across the different district viz. Jalukie, Kohima, Wokha, Zunheboto and Longleng of Nagaland was evaluated over here in terms of higher production potential under the rainfed condition. Results revealed that significant variations were observed in growth and yield attributes of jobsteer lines. Among the tested lines of jobsteer, JBN-10 line recorded the significantly higher yield attributes which led to higher grain yield as compared to other lines.

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Introduction

The North East region has its own unique combination of living species, habitats and ecosystems which together make up its diversity rich resource. While speaking strictly about the plant diversity, two regions of the country are termed as hot spots i.e. Western Ghat and North Eastern Hill Region, in which Nagaland is one of the hot spot for biodiversity. Job's tear is the grain of a tropical Asian grass (*Coix lacryma-jobi*) originated from South-East Asia. Job's Tears is also known as *Adlay* (Filipion), *Jagradi* in

Table 1. Details of job's tear germplasm collected.

Job's tear line	Local name	Village	District	Farmer's name	Altitude	Latitude	Longitude
JBN-1	Kejanglwa local-1	Kejanglwa	Peren	Gongrai	735 m asl	25°35 N	93°41 E
JBN-2	Kejanglwa local-2	Kejanglwa	Peren	Gongrai	735 m asl	25°35 N	93°41 E
JBN-3	Phesama local	Phesama	Kohima	Zevilhuono	1600 m asl	25°37 N	94°07 E
JBN-4	Longsa local	Longsa	Wokha	Loth Ezung	1470 m asl	26°03 N	94°15 E
JBN-5	Koio local	Koio	Wokha	Ramongo	1255 m asl	26°07 N	94°18 E
JBN-6	Yanthamo local	Yanthamo	Wokha	Yanamo Odyuo	1418 m asl	26°04 N	94°17 E
JBN-7	Yikhum local-1	Yikhum	Wokha	Lochoni	1246 m asl	26°07 N	94°14 E
JBN-8	Yikhum local-2	Yikhum	Wokha	Lochoni	1246 m asl	26°07 N	94°14 E
JBN-9	Longsachung local	Longsachung	Wokha	Zuchobeni	1703 m asl	26°03 N	94°15 E
JBN-10	Wokha local-1	Wokha village	Wokha	Libeni Tungoe	1250 m asl	25°35 N	93°41 E

Sanskrit, *Sankru* in Hindi, *Gurgur* in Bengali, *Megaru* in Garo, *Sohriew* in *Khasi* and *Kunch* in Tripuri [1]. These grains have a number of uses from foods to ornaments and cultivated for thousand of years. Many Asian markets sell them in grain sections for cooking. Beaders and crafts people also use grains and they may be found at beading and craft stores. Plants are also cultivated as ornamentals, incidentally and Western gardeners may not be aware that large grains on these grasses are perfectly edible. *Coix* grains are used as substitute for rice and roasted, husked and eaten whole or parched like maize or boiled with water as rice. A 100 g edible portion of the husked grain of job's tear contains: water 10.1–15 g, protein 9.1–23 g, fat 0.5–6.1 g, carbohydrates 58.3–77.2 g, fiber 0.3–8.4 g and ash 0.7–2.6 g [2]. Despite its minor crop status, job's tear is a nutritious grain, containing more fat and protein than rice and wheat [3]. *Coix* grain used as fodder has greater protein content, making its more advantages than corn. Food scientists have found that job's tear is a rich source of photochemical, having actions of anti-inflammatory, as well as a detoxifying agent. Job's tear is native to SE Asia and distributed throughout the tropical and subtropical parts of the world for its fodder and medicinal values. It has a wide range of adaptability and can be grown even under considerable moisture stress condition and impoverished soil. Its cultivation is reported in Philippines, India, China, Siam, Myanmar and Sri Lanka. In India, this plant is found in warm slope of hills up to an elevation of 1600 m particularly in North Eastern states [4]. It has a wide adaptability ranging from cool temperate moist to wet through triopical very dry to

wet forest life zones, Job's tear is reported to tolerate annual precipitation of 6.1–42.9 mm, annual temperature of 9.6–27.8°C and pH of 4.5–8.4. With respect to area, production and productivity in Nagaland, it is cultivated over an area of 1,110 ha produced 1,110 ton with a productivity of 1000 kg/ha. The diversity of several important crops including jobstear spread across the world is threatened by rapid urbanization and habitat erosion as well as unpredictable and extreme climatic event including increasing frequency of drought and heat. The concerted and intensive effort are required to identify the climate-change-resilient jobstear lines, while accelerating yield without which outcome well be hunger and food insecurity for poor farmers of hilly region. The present investigation was carried with the objective to identify the best performing, high yielding Job's Tear lines under foot hill condition of Nagaland.

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Materials and Methods

A systematic survey had been conducted during the 2014-2015 to collect the local jobstear germplasm from different district of Nagaland. A team of expert comprising of scientist, technical officers and SRF went for the exploration program. The team discussed with local agricultural officers and KVKs and identified important jobstear growing regions in the states.

Table 2. Growth performance of Job's tears line under rainfed condition (mean data on one year). *DFF: Days to 50% flowering.

Job's tear line	Plant height (cm)	Tillers/ plant (No.)	Green leaves/ plant (No.)	Inter- nodes/ plant (No.)	Dry matter plant (g)	DFF* (No.)	Days to matu- rity (No.)
JBN-1	261.11	7.33	66.67	16.41	75.10	105	163
JBN-2	220.29	6.00	66.00	15.02	80.52	115	163
JBN-3	161.01	5.00	48.50	13.10	70.34	111	165
JBN-4	167.10	4.00	48.00	12.11	61.13	110	161
JBN-5	178.91	3.50	40.33	13.39	60.10	110	151
JBN-6	153.32	4.17	32.83	12.42	30.29	115	161
JBN-7	183.41	3.83	40.17	14.53	40.00	106	151
JBN-8	195.09	2.67	34.83	10.19	43.34	103	151
JBN-9	233.03	5.00	71.67	12.20	73.63	105	149
JBN-10	251.12	4.83	58.67	13.23	84.10	92	149
SEM±	5.38	0.11	1.32	0.34	1.66	0.84	0.72
LSD ($p=$ 0.05)	15.98	0.34	3.92	1.01	4.94	2.49	2.15

The ream surveyed door to door and *jhum* fields for collecting the local jobstea germplasm. The details of germplasm collected from different places are mentioned below in Table 1. The field experiment was carried out at Agricultural Research Farm of ICAR Research Complex for North Eastern Hilly Region, Nagaland Center, Jharnapani, Medziphema during the pre-kharif season of 2015. The experimental site was located at 25°45' N latitude, 93°53' E longitude with mean altitude of 295 m above the mean sea level. Experiment was laid out in completely randomized block design with three replications consisting of 10 lines of job's tear viz., JBN-1, JBN-2, JBN-3, JBN-4, JBN-5, JBN-6, JBN-7, JBN-8, JBN-9 and JBN-10 (Table 1). The experimental soil was sandy loam with pH 5.3, high in organic carbon (0.78%), low in available N (175.4 kg/ha) and K₂O (138.5 kg/ha) and moderate in available P₂O₅ (18.0 kg/ha) as well as available sulfur (15.8 kg/ha). The whole experimental field was divided into 3 equal blocks and each block was again divided into 10 equal plots. The lines were randomly allotted to plot size of 5.0 m × 3.0 m size maintaining a spacing of 0.5 m between the plots. The seeds were sown @ 15 kg/ha in lines maintaining a spacing of 45 cm × 15 cm. The recommended dose of fertilizers (100% RDF) viz. 40 kg/ha N, 20 kg/ha P₂O₅, 20 kg/ha K₂O and 20 kg/ha S were applied through urea (46% N), di-ammonium

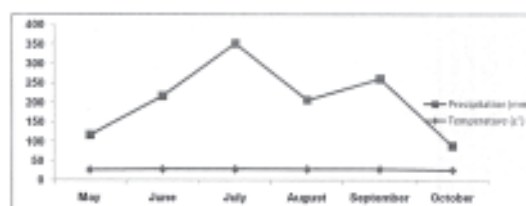


Fig. 1. Meteorological observation during the period of experimentation.

phosphate (18% N and 46% P₂O₅) and nuriate of potash (60% K₂O), and elemental sulfate (90% S), respectively. Sulfur was applied as per treatment two weeks before the sowing. Half of the entire quantity of N and full quantity of P and K were applied as basal according to the treatments. The remaining dose of nitrogen was top dressed after one month of sowing. Weeding was done manually using hoe at 20 and 35 days after sowing. The observations were recorded on growth attributes viz. plant height, tillers/plant, green leaves/plant, internodes/plant, yield attributes viz. panicle length, panicle/plant, grains/panicle and yields at harvest stage along with phonological characters viz. days to 50% flowering and days to maturity. Weather data on rainfall and temperature during crop growth period were collected and depicted in Figure 1.

Statistical analysis

The experimental data pertaining to each parameters of study were subjected to statistical analysis by using the technique of analysis of variance and their significance was tested by *F* test [5]. Standard error of means (SEM±) and least significant difference (LSD) at 5% probability ($p=0.05$) were worked out for each parameter studied to evaluate the differences between treatment means.

Results and Discussion

Effect of weather

The weather conditions prevailing during the crop season was found to be more or less conducive (Fig.

Table 3. Yield attributes and yield of Job's tear lines grown under upland condition (mean data on one year).

Lines	Panicle length (cm)	Panicles/plant (No.)	Grains/panicle (No.)	Seed yield plant (g)	1000-Seed weight (g)	Seed yield (kg/ha)
JBN-1	31.15	3.75	56.50	43.86	6.75	622.12
JBN-2	28.29	3.75	85.00	25.81	8.04	366.09
JBN-3	23.30	4.00	24.15	18.80	13.18	266.66
JBN-4	23.10	2.75	36.34	17.00	10.45	241.13
JBN-5	33.21	3.00	62.67	25.14	9.45	356.59
JBN-6	21.19	3.00	30.10	14.80	7.39	209.92
JBN-7	39.05	3.75	94.00	28.85	5.07	409.21
JBN-8	41.34	3.50	88.05	14.08	5.81	199.71
JBN-9	37.10	4.00	42.30	62.38	12.03	884.82
JBN-10	34.00	4.25	65.29	62.58	13.01	887.65
SEm±	0.91	0.09	1.82	0.88	0.25	12.50
LSD						
(<i>p</i> =0.05)	2.70	0.27	5.41	2.62	0.75	37.13

1). The results of the present investigation in general indicated that temperature was normal but amount of rainfall varied appreciably from normal during the crop growth period. It is a well known fact that each crop species has a definite range of temperature for different growth stages. Beyond the upper and lower threshold of temperature, the metabolic activity proceeding germination is reduced.

Growth attributes

Table 2 shows the growth attributes of jobstear lines had significant differences. Among the tested jobstear lines, taller plants (261.1 cm) were recorded with JBN-1 line, which was statistically at par with JBN-10, while JBN-6 recorded the shortest plants (153.32 cm) which was at par with JBN-3 and JBN-4. With regards to the number of tillers, the maximum number of tillers/plant was recorded in JBN-1 (7.33) and the lowest in JBN-8 (2.67). The highest number of active leaves/plant was recorded in JBN-9 line (71.67) and lowest was recorded in JBN-6 (32.83) which was statistically at par with JBN-8. The number of internodes/plant was found to be maximum with JBN-1 (16.41) line and the minimum values associated with JBN-8 (10.19). In case of dry weight production/plant, JBN-10 line recorded the highest dry matter production (84.1 g) among the tested line, which was statistically similar to JBN-2. The lowest dry matter production was associated with

JBN-6 (30.29 g). Significant variations among the jobstear genotypes in growth components have also been reported by various researchers [6, 7].

Crop ontogeny

Among the tested line of jobstear, JBN-2 and JBN-6 line took the maximum number of days to 50% flowering (115 days) and JBN-10 line took lowest number of days to 50% flowering (92 days). However, JBN-3 line took the maximum days to maturity (165 days), which was statistically similar to JBN-2 and JBN-3, while JBN-9 and JBN-10 took the minimum days to maturity (149 days). In general, all the Job's Tear lines attained maturity between 149 to 165 DAS.

Yield attributes

Significant differences were observed with respect to yield attributes among the different lines of jobstear (Table 3). With regard to panicle length, JBN-8 recorded the maximum length (41.34 cm), which was statistically similar to JBN-7, while JBN-6 recorded the minimum length (21.19 cm), which was statistically similar to JBN-3 and JBN-4. The highest number of panicles/plant (4.25) was found with JBN-10 line, which was statistically similar with JBN-3 and JBN-9, however the minimum number of panicles/plant was found in JBN-4 line (2.75), which was statistically similar to JBN-5 and JBN-6. The highest grains/panicle (94) was recorded in JBN-7 line and the lowest values were associated with JBN-3 (24.1). Significant variations among the jobstear genotypes in yield attributes have also been reported by various researchers [6, 7].

Grain yield

Grain yield as influenced markedly with respect to different jobstear line (Table 3). With regards to grain yield/plant, JBN-8 line recorded the lowest grain yield/plant (14.08 g), which was statistically at par with JBN-6 line leading to the lowest yield/ha (199.71 kg). Similarly, JBN-10 recorded the highest yield/plant (62.58) leading to the highest grain yield/ha (887.65 kg), which was statistically similar to JBN-9. Significant variations among the Job's tear genotypes in yield have also been reported by various researchers [3].

Possible impact

Job's tear may opt a place in uncultivated and marginal lands. There appears to be a tremendous potential for cultivating *coix* in hills ecosystem to sustain the tribal livelihood. The major bottlenecks of production and processing technology need to be resolved by taking research on priority areas viz. yield enhancement by increasing harvest index, synchronous maturity, lodging resistant. A population improvement program for locally adapted varieties as well as program for development of composites in *coix* may be undertaken by research center located in the hills. Besides promoting *coix* cultivation in the upland of hills, special efforts should be made to introduce *coix* cultivation to uncultivated marginal and degraded lands in hills. This will not only generate income for poor farmers but also improve the structure of these lands to sustain agriculture for future generations. A concerted effort are thus, needed by research institutions, farmers in making improvement of such valuable crop.

Conclusion

From this study, it can be concluded that there is enough scope for cultivation of jobstear in upland

hill ecosystem condition. Therefore, the tested lines of jobster JBN-10, which showed outstanding performances in terms of production potential is, therefore recommended for commercial cultivation under foot hill condition of Nagaland.

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