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STUDY OF GROWTH AND DEVELOPMENT FOR FIBRE PRODUCTIVITY IN DIFFERENT GENOTYPES OF JUTE AND KENAF

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Abstract: The present investigation on study of growth and development for fibre production in different genotypes of Jute and Kenaf was undertaken to study the comparative performance of genotypes of two different fibre producing crops and their contribution towards fibre yield. The nine observations were recorded on crop phenology, morphological growth characters, yield and yield contributing characters *viz*., days to initiation of flowering, days to 50% flowering, plant height (cm), basal diameter (cm), number of leaves per plant, leaf area per plant (dm^2), dry matter accumulation (g/plant), green yield (q/ha), fibre yield (q/ha). Days to initiation of flowering and 50% flowering had significant impact on fibre yield indicating their importance for selection in fibre quality improvement programme. The plant height, basal diameter (cm), number of leaves per plant, leaf area per plant (dm^2), dry matter accumulation (g/plant) recorded at 15 days interval from 30 days after sowing had direct positive effect for the contribution to green yield and fibre yield.

Keywords: Jute, Kenaf, yield

I. INTRODUCTION Jute is second largest commercial natural fibre crop next to cotton. Jute is an annual herbaceous plant that typically grows to a height of about 3-4 meters and has a diameter of around 2 cm. Its leaves are petiolate with a triangular blade, approximately 15 cm in length and 5 cm in width. The fibre is extracted from the phloem vessels. Jute fibres are lengthy, coarse and shiny bast fibre that can be spun into durable, coarse threads. The fibre length is between 1 and 4 m. Jute attains maturity in 3-4 months after that harvesting and retting is done to obtain fibre. Jute plants have the genus Corchorus within the Malvaceae family with two types of cultivated species :

1) *Corchorus capsularis* (white jute): covering nearly 70% of total cropped area and can thrive in both high and low lands.

2) *Corchorus olitorius* (tossa jute): This species is cultivated only on well-drained high lands. The fibres are off white to brown coloured thus called as 'Golden Fibre'.

Jute sacks are utilized for sustainable and stiff packaging of agricultural commodities, alternative to wood pulp for paper making, for making gunny cloth, bags, ropes, twine, matting, high-quality industrial yarn, fabric, nets, and sacks. These products serve as raw materials for various sectors, including packaging, textiles, non-textiles, construction and agriculture.

Kenaf - *Hibiscus cannabinus*, also known as Deccan hemp and Java jute, is a plant in the Malvaceae family. Kenaf is one of the allied fibres of jute and shows similar characteristics. Kenaf is an annual, dicotyledonous, herbaceous fibre crop that can grow to a height of 1.5-4.5 meters with a woody base. Its leaves are 10-15 cm long, and their shape varies with plant age and cultivar. Only 6% of the total weight of both the plant is composed of fibre.

Kenaf is a versatile plant with numerous applications like its robust & durable fibres are used to produce items like ropes, twines, canvas, burlap sacks, paper industry, fabrics for clothing & other textile products, to create composites for use in construction and automotive parts. The stalks of plant can be used as a substrate for mushroom cultivation. Also used as due to rich source of cellulose and produce good quality paper. Versatility and sustainability make it a promising resource for various industries seeking more eco-friendly solutions. This triggered the need for more comprehensive research for increasing yield potential and production area of crops.

In the present investigation, growth and development traits of genotypes of two crop (Jute and Kenaf) were studied and determined which genotypes performs best, so that their selection can be used for genetic improvement in yield. In the present investigation the performance of both the crop studied compartively for different traits including fibre yield.

II. MATERIAL AND METHODS

The experiment was laid out in randomized block design (RBD) with three replications having eight genotypes at Cotton Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri - 413 722 (M.S.). The experimental material consisted of eight genotypes, four genotypes of Jute (JRO-524, JRO-204, JROP-4, CO-58) and four genotypes of Kenaf (HC-583, AMC-108, JRK-2017-1, JRK-2017-2) which were provided by AINP on Jute and allied fibres, MPKV, Rahuri. The data will be analyzed through randomized block design by Panse and Sukhatme (1985).

III. RESULTS AND DISCUSSION

Association of fibre yield with other characters

The characters *viz.*, days to initiation of flowering, days to 50% flowering, plant height (cm), basal diameter (cm), number of leaves per plant, leaf area per plant (dm^2), dry matter accumulation (g/plant), green yield (q/ha), fibre yield (q/ha), unit area efficiency, harvest index showed highly significant positive association with the green yield and fibre yield.

Other workers additionally discovered significant positive association with fibre yield *viz.*,

Cheng and Li (1982) reported the problem of early flowering in jute crop. It caused 45-50 per cent reduction in fibre yield.

Sobhan and Khatun (1982) found that base diameter has close association with fibre yield than plant height in kenaf. The highest basal diameter in combination with plant height gave the maximum fibre yield per plant.

Petrini *et al.* (1994) and Alexopolou *et al.* (2000) stated that flower initiation caused reduction in vegetative growth of kenaf.

Ahmad *et al.* (1995) concluded that dry matter accumulation in leaf, bark and stick of kenaf was found maximum at 75–100 days.

Palit *et al.* (1996) reported that highly significant positive relation between plant height and fibre yield per plant.

Roy and Ghosh (2004) studied the association of leaf characters with fibre yield, plant height and basal diameter in tossa jute. They observed that plant height, basal diameter, leaf length had highly significant and positive correlation with fibre yield.

Kumar *et al.* (2014) and Ali *et al.* (2002) found that the comparison of genotypes showed that the taller genotypes recorded higher fibre yield and dwarf genotypes had lower fibre yield. These findings from other scientists confirms the present findings.

In present study most of the morphological characters, have positive association with yield contributing characters which indicates that these characters are useful in yield improvement.

Days to initiation of flowering

The mean number of days for initiation of flowering was 72.83 days for Jute and 79 days for kenaf. Among Jute, genotype JROP-4 required highest number of days (76 days) and among Kenaf, genotype JRK-2017-2 required highest number of days (82 days) for initiation of flowering. Delayed flowering allows longer vegetative growth which leads to higher fibre yield and better fibre quality. Early flowering induced by high temperature shortens the vegetative growth and reduces overall fibre yield and quality. These findings were supported by Petrini *et al.* (1994) and Alexopolou *et al.* (2000).

Days to 50% flowering

The mean number of days for 50% flowering was 98.42 days for Jute and 100.25 days for kenaf genotypes. Among Jute, genotype JROP-4 required highest number of days (100.33 days) for 50% flowering and it was at par with genotypes CO-58 (99 days). Among Kenaf, genotype JRK-2017-2 required highest number of days (102.66 days) for 50% flowering. Both the plants are harvested at 50% flowering stage for better quality fibre and yield.

Plant height (cm)

The mean plant height for Jute ranged between 32.96 cm to 258.85 cm and for Kenaf 58.52 cm to 291.53 cm. Genotype JROP-4 of Jute and JRK-2017-2 of Kenaf recorded significantly the highest plant height in all 15 days interval. Kenaf has higher plant height compared to Jute. The genotype of higher plant height will be resulted with high fibre yield at harvest was observed in this present investigation. These findings were supported by Palit *et al*. (1996). Kumar *et al.* (2014) and Ali *et al.* (2002) found that the comparison of genotypes showed that the taller genotypes recorded higher fibre yield and dwarf genotypes had lower fibre yield.

Basal diameter (cm)

The mean basal diameter for Jute ranged between 0.57 cm to 2.00 cm and for Kenaf 0.72 cm to 2.29 cm. Genotype JROP-4 of Jute and JRK-2017-2 of Kenaf recorded significantly the highest basal diameter in all 15 days interval. Kenaf recorded higher basal diameter compared to Jute. A larger basal diameter indicates a thicker stem, which can support more robust growth and higher fibre production. This result supported by Sobhan and Khatun (1982).

Number of leaves per plant

The mean number of leaves for Jute genotypes ranged between 16.42 to 240.58 and for Kenaf 34.92 to 277.25. The genotype JROP-4 of Jute and JRK-2017-2 of Kenaf recorded significantly the highest number of leaves in all 15 days interval. Kenaf recorded higher number of leaves compared to Jute. The higher number of leaves results in increasing the biological yield by increasing photosynthetic activities and assimilates for the development of reproductive sink and increasing dry matter production. These findings were support by Roy *et al.* (2004).

Leaf area (dm^2)

The mean leaf area for Jute ranged between 19.94 dm^2 to 61.49 dm^2 and for Kenaf 30.37 dm^2 to 76.28 dm^2. The genotype JROP-4 of Jute and JRK-2017-2 of Kenaf recorded significantly the highest leaf area in all 15 days interval. Kenaf recorded higher leaf area compared to Jute. Larger leaf area leads to increased photosynthetic capacity and greater biomass production which is crucial for higher fibre yield.

Dry matter accumulation (g/plant)

The mean dry matter accumulation for Jute ranged between 19.03 g to 111.85 g/plant and 32.30 g to 135.84 g/plant for Kenaf genotypes. Genotype JROP-4 of Jute and JRK-2017-2 of Kenaf recorded significantly the highest dry matter accumulation in all 15 days interval. Kenaf recorded higher dry matter accumulation compared to Jute. Since stem is primary source of fibre, increased dry matter leads to higher fibre yield. This result was supported by Ahmad *et al.* (1995).

Green yield (q/ha)

The mean green weight at harvesting for Jute was 465.56 q/ha. Among Jute, significantly the highest green weight recorded by JROP-4 (519.67 q/ha) and the genotype JRO-524 (427.85 q/ha) have lowest green weight. The mean green weight at harvesting for Kenaf was 581.78 q/ha. Among Kenaf, significantly the highest green weight recorded by JRK-2017-2 (658.18 q/ha) and the genotype AMC-108 (539.93 q/ha) have lowest green weight. Kenaf recorded higher green yield compared to Jute.

Fibre Yield (q/ha)

The mean fibre yield at harvesting for Jute was 23.40 q/ha. Among Jute, significantly the highest fibre yield recorded by JROP-4 (26.50 q/ha) and the genotype JRO-524 (21.39 q/ha) recorded lowest fibre yield. The mean fibre yield at harvesting for Kenaf was 29.68 q/ha. Among Kenaf, significantly highest fibre yield recorded by JRK-2017-2 (33.56 q/ha) and the genotype AMC-108 (27 q/ha) have lowest fibre yield. Kenaf recorded higher fibre yield compared to Jute.

Unit Area Efficiency

It is expressed as the quantum of fibre yield produced per unit land area for a specified crop growth period. Higher UAE indicates that more yield is obtained from same amount of land.

The mean Unit Area Efficiency for Jute was of 2.23. The genotype JROP-4 (2.52) recorded significantly the highest UAE. The mean Unit Area Efficiency for Kenaf was 2.83. The genotype JRK-2017-2 (3.19) recorded significantly the highest UAE. Kenaf recorded higher unit area efficiency as compared to Jute.

Harvest Index

Harvest index is a measure of efficiency of a crop in converting its biomass into economic yield. A higher harvest index indicates that greater proportion of plant's biomass is being allocated to economical parts rather than non-harvestable parts.

The mean harvest index for Jute was of 16.99. The genotype JROP-4 (17.21) and JRO-204 (17.01) recorded the highest harvest index. Among Kenaf, the mean harvest index for Kenaf was 19.13. The genotype JRK-2017-1 (19.51) recorded the highest harvest index. Kenaf recorded higher harvest index as compared to Jute.

IV. CONCLUSION

Considering phenological and morphological parameters *viz.*, days to initiation of flowering, days to 50% flowering, plant height (cm), basal diameter (cm), number of leaves per plant, leaf area per plant (dm^2), dry matter accumulation (g/plant), green yield (q/ha), fibre yield (q/ha), it is observed that these components have direct effect on yield in both Jute and Kenaf. Among Jute, genotype JROP-4 and JRK-2017-2 of Kenaf recorded significantly highest values for all characters at all 15 days interval. Both

the genotypes should be preferred due to their best performance in terms of growth and development. Kenaf genotypes performs best as compared to Jute for all morphological characters at all stages of growth and high in fibre yield, unit area efficiency and harvest index. The emphasis should be given on these morphological characters for improving the fibre yield in present set of genotypes.

Table No. 1: Phenological parameters influenced by Jute and Kenaf genotypes

Sr. No.	Genotypes	Days to initiation of flowering	Days to 50% flowering (Days to maturity for fibre production)
Jute 1	JRO-204	72.00	97.67
2	JRO-524	70.33	96.67
3	JROP-4	76.00	100.33
4	CO-58	73.00	99.00
Mean		72.83	98.42
Kenaf 1	AMC-108	77.00	98.00
2	HC-583	78.00	100.00
3	JRK-2017-1	79.00	100.33
4	JRK-2017-2	82.00	102.67
Mean		79.00	100.25
S.E.(m) ±		0.83	0.71
CD at 5%		2.52	2.16

Table 2: Plant height (cm) influenced by Jute and Kenaf genotypes

Sr. No.	Genotypes	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	105 DAS
Jute 1	JRO-204	30.00	94.53	170.20	215.73	248.20	256.10
2	JRO-524	26.03	88.80	162.70	207.47	242.23	250.07
3	JROP-4	40.70	118.83	181.90	229.83	260.33	268.37
4	CO-58	35.10	103.83	176.23	220.80	252.77	260.87
Mean		32.96	101.50	172.76	218.46	250.88	258.85
Kenaf 1	AMC-108	49.73	126.34	200.03	241.03	267.57	280.67
2	HC-583	54.83	135.87	207.20	259.23	271.97	286.13
3	JRK-2017-1	60.63	148.23	215.57	268.13	279.97	295.47
4	JRK-2017-2	68.90	156.10	224.53	276.97	289.33	303.87
Mean		58.52	141.64	211.83	261.34	277.21	291.53
S.E.(m) ±		1.00	2.54	1.74	2.02	1.83	1.64
CD at 5%		3.07	7.79	5.33	6.19	5.59	5.02

Basal diameter (cm) influenced by Jute and Kenaf genotypes

Genotypes	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	105 DAS
JRO-204	0.50	0.84	1.19	1.51	1.76	1.90
JRO-524	0.44	0.78	1.08	1.42	1.69	1.84
JROP-4	0.70	1.06	1.40	1.77	1.99	2.21
CO-58	0.63	0.96	1.31	1.61	1.84	2.05
	0.57	0.91	1.25	1.58	1.82	2.00
AMC-108	0.62	0.84	1.35	1.70	1.95	2.18
HC-583	0.70	0.91	1.40	1.77	2.00	2.24
JRK-2017-1	0.74	1.01	1.53	1.83	2.07	2.32
JRK-2017-2	0.81	1.25	1.60	1.90	2.18	2.40
Mean	0.72	1.00	1.47	1.80	2.05	2.29
S.E.(m) ±	0.02	0.03	0.03	0.03	0.03	0.02
CD at 5%	0.07	0.10	0.09	0.10	0.10	0.05

Table 3: Number of leaves per plant influenced by Jute and Kenaf genotypes

Sr. No.	Genotypes	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	105 DAS
Jute 1	JRO-204	14.00	51.00	224.00	237.00	112.67	32.67
2	JRO-524	12.33	45.33	209.00	229.67	106.33	28.67
3	JROP-4	21.00	67.00	243.33	251.00	130.00	43.00
4	CO-58	18.33	60.00	231.33	244.67	121.00	37.00
Mean		16.42	55.83	226.92	240.58	117.50	35.33
Kenaf 1	AMC-108	28.00	140.33	244.67	260.67	133.00	68.33
2	HC-583	32.00	130.67	253.33	273.00	136.67	65.67
3	JRK-2017-1	35.33	150.67	261.00	282.33	142.67	73.00
4	JRK-2017-2	44.33	158.67	273.67	293.00	150.67	77.33
Mean		34.92	145.08	258.17	277.25	140.75	71.08
S.E.(m) ±		1.62	1.88	2.78	2.61	3.40	3.58
CD at 5%		4.95	5.74	8.50	7.99	10.41	10.97

leaf area (dm^2) per plant influenced by Jute and Kenaf genotypes

Genotypes	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	105 DAS
JRO-204	18.50	32.67	45.27	59.13	42.33	39.40
JRO-524	15.67	29.63	41.57	55.17	38.77	36.53
JROP-4	24.00	40.60	53.70	68.67	50.27	44.47
CO-58	21.60	35.63	49.40	63.00	46.00	41.70
	19.94	34.63	47.48	61.49	44.34	40.53
AMC-108	25.00	41.37	54.47	69.60	45.37	41.93
HC-583	29.03	45.53	59.13	73.03	51.37	46.43
JRK-2017-1	31.83	48.07	63.03	78.73	55.43	50.80
JRK-2017-2	35.60	52.43	66.73	83.77	60.73	56.07
Mean	30.37	46.85	60.84	76.28	53.23	48.81
S.E.(m) ±	0.84	0.84	1.00	1.16	0.94	1.07
CD at 5%	2.56	2.58	3.07	3.57	2.89	3.29

Table 4: Dry matter accumulation (g/plant) influenced by Jute and Kenaf genotypes at various stages of growth

Sr. No.	Genotypes	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	105 DAS
Jute 1	JRO-204	17.97	45.33	57.87	67.47	86.87	108.70
2	JRO-524	15.97	40.70	51.87	61.23	82.17	102.00
3	JROP-4	22.43	53.80	71.47	81.87	102.27	121.47
4	CO-58	19.73	48.63	64.67	73.50	93.90	115.23
Mean		19.03	47.12	61.47	71.02	91.30	111.85
Kenaf 1	AMC-108	26.60	61.90	76.30	90.03	108.10	128.67
2	HC-583	30.63	67.50	83.20	95.33	113.70	133.83
3	JRK-2017-1	34.30	74.23	88.77	101.67	120.93	137.63
4	JRK-2017-2	37.67	79.07	94.73	108.57	125.90	143.23
Mean		32.30	70.68	85.75	98.90	117.16	135.84
S.E.(m) ±		0.62	1.37	1.60	1.41	1.06	1.61
CD at 5%		1.89	4.21	4.91	4.33	3.24	4.92

Table No. 5: Yield and yield contributing characters by Jute and Kenaf genotypes at harvest

Sr. No.	Genotypes	Green weight (q/ha)	Fibre Yield (q/ha)	Unit Area Efficiency	Harvest Index (%)
Jute 1	JRO-204	446.00	22.30	2.12	17.01
2	JRO-524	427.85	21.39	2.04	16.88
3	JROP-4	519.67	26.50	2.52	17.21
4	CO-58	468.75	23.44	2.23	16.88
Mean		465.56	23.40	2.23	16.99
Kenaf 1	AMC-108	539.93	27.00	2.57	18.76
2	HC-583	552.85	28.19	2.69	19.13
3	JRK-2017-1	576.77	29.99	2.86	19.51
4	JRK-2017-2	658.18	33.56	3.19	19.13
Mean		581.78	29.68	2.83	19.13
S.E.(m) ±		13.35	0.679	0.07	0.19
CD at 5%		40.49	2.059	0.20	0.57

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V. LITERATURE CITED

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