

Effect of sowing and harvesting time on pulpable biomass yield of kenaf (*Hibiscus cannabinus*)

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ABSTRACT

A field experiment was conducted during 1997 and 1998 to find out ideal sowing and harvesting time on the pulpable biomass yield of kenaf (*Hibiscus cannabinus* L.) at Regional Research Laboratory, Jorhat. Crops sown in April matured in shortest duration (184 days), producing tallest kenaf plants (3.633 m) having largest basal diameter (2.250 cm) with maximum yield of pulpable dry biomass (16.8 tonnes/ha). Harvesting of kenaf at 180 days maturity yielded maximum biomass (16.3 tonnes/ha), recording highest mean increment (2.7 tonnes/ha). The vegetative growth ceased at the stage of flowering (180 days) attaining maximum yield of biomass, indicating appropriate stage for harvesting the crop.

Key words : Kenaf, Sowing time, Harvesting time, Biomass yield, Increment

Kenaf has been cultivated in many parts of Assam as a fibre crop, substituting for jute for the manufacture of ropes, nets, carpets, mats, sacks and hessian cloth, but not for its pulpable biomass as an industrial crop for pulp and paper industry. Therefore, after utilizing the bark (bast fibre), which constitutes only 20% of the total dry weight of the stalk, the remaining portion of the stalk is generally used as fuel or fencing material (Sarma *et al.*, 1986). To obtain maximum yield of pulpable biomass, apart from other agronomic parameters, determination of sowing and harvesting time are

important factors contributing to higher yield of kenaf. Early and late sowing may lead to low yield of crop. However, harvesting of kenaf at an appropriate stage for maximum biomass yield is important, while cultivating it as industrial crop for paper making. But no information is available on an appropriate time of sowing and age of harvesting kenaf, while growing it under the rainfed conditions of Assam. Therefore, an experiment was conducted to determine the ideal time of sowing and stage of harvesting kenaf for maximum yield of pulpable biomass.

MATERIALS AND METHODS

The field experiment was carried out during 1997 and 1998 at the farm of Regional Research Laboratory, Jorhat. The soil was sandy loam having pH 5.6, contained 0.53% organic carbon. It was low in available nitrogen (188 kg/ha), medium in available phosphorus (15 kg/ha) and rich in available potassium (358 kg/ha). The trial on sowing time was designed with 12 sowing dates (January to December), plot size 25 m², replication 3, total unit 36 and conducted under randomized block design. Seeds of kenaf were sown at a row spacing of 40 cm on every 15th day of the 12 months. The other trial on harvesting time was laid out with 5 harvesting schedules, i.e. 90, 120, 150, 180 and 210 days after sowing of seeds; plot size 25 m² having 30 units with 6 replications under randomized

block design. Seeds were sown at 40 cm row spacing on 15 April of each year. Application of nitrogen (200 kg/ha), phosphorus (50 kg/ha) and potash (50 kg/ha) was uniform for both the trials. Nitrogen was applied in 2 spit doses, one (100 kg/ha) at the time of land preparation along with whole of P and K₂O and second dose (100 kg/ha) after the first interculture done at 60 days of sowing seeds. In the trial on sowing time, harvesting of kenaf was done during the time of flowering and for the other experiment as schedule. Observations on plant height, basal diameter and pulpable biomass yield were recorded for both the years from 10 random plants/plot. The biomass of kenaf stalk (over ground) without leaves, flowers and seed considered as pulpable biomass, which was used for making pulp.

Table 1. Days required for maturity, plant height, basal diameter and biomass yield of kenaf under different sowing time

Sowing month	Days required for maturity		Plant height (m)		Basal diameter (cm)		Dry biomass yield (tonnes/ha)	
	1997	1998	1997	1998	1997	1998	1997	1998
January	200.3	199.0	2.450	2.410	1.660	1.730	13.466	13.330
February	194.6	198.3	3.316	2.470	1.930	1.860	14.860	14.730
March	187.0	184.0	3.450	2.500	1.966	2.033	15.600	15.630
April	185.3	183.3	3.633	3.630	2.266	2.233	16.730	16.960
May	188.3	187.3	3.596	3.590	2.133	2.166	16.430	16.500
June	284.6	282.0	3.300	3.330	1.966	1.966	15.730	15.860
July	280.3	279.6	3.000	3.203	1.533	1.466	13.600	13.660
August	240.6	243.0	2.883	2.950	1.300	1.400	11.300	11.500
September	231.0	230.0	2.840	2.833	1.266	1.333	10.430	10.400
October	225.3	224.3	1.950	2.230	1.233	1.300	1.530	9.500
November	225.0	215.3	2.066	1.916	1.330	1.433	9.350	9.500
December	205.6	206.0	2.083	2.080	1.360	1.466	9.330	9.530
CD (P = 0.05)	1.265	1.585	0.669	0.047	0.128	0.105	0.181	0.171

RESULTS AND DISCUSSION

Sowing time

Highly significant differences were observed for plant maturity, height, basal diameter and biomass yield due to different sowing time. Crops sown in April matured in shortest duration, producing tallest kenaf plant with largest basal diameter (2.25 cm) along with maximum yield of dry biomass. The yield of stalk gradually increased from the crops sown in January reaching the peak in April and then started declining till October, after which increasing trend was noted (Table 1).

The ideal time of sowing kenaf seeds is the first fortnight of June in North-Western India (Dutta and Fotedar, 1979) and April in North-East India (Sarma *et al.*, 1991)

before onset of monsoon. Similar findings were also observed by Muchow (1981) and Wood (1981) in Australia and recorded maximum yield of kenaf stalk from the crops sown prior to onset of monsoon.

Harvesting time

Progressive increase in plant height, basal diameter and biomass yield was recorded with the increase in age of kenaf. All these yield-attributing factors were significant when harvesting was done at 180 days of plant maturity (height 3.7 m, basal diameter 2.0 cm and biomass yield 16.3 tonnes/ha). The biomass yield did not increase significantly after the harvesting age of 180 days. The highest mean biomass increment (2.7 tonnes/ha) was observed in

Table 2. Plant height, basal diameter and biomass yield of kenaf under different harvest time

Harvest time (days after sowing)	Plant height (m)		Basal diameter (cm)		Dry biomass (tonnes/ha)	
	1997	1998	1997	1998	1997	1998
90	2.380	2.391	1.366	1.350	4.483	4.380
120	2.566	2.525	1.600	1.633	7.360	7.410
150	3.475	3.425	1.833	1.766	12.233	12.400
180	3.725	3.716	2.033	2.035	16.750	16.745
210	3.730	3.720	2.036	2.040	16.760	16.800
CD (P = 0.05)	0.052	0.040	0.064	0.068	0.288	0.228

Table 3. Current and mean increments in dry biomass yield at 30 days harvest time interval in kenaf

Harvest time days after sowing	Dry biomass increment (tonnes/ha)			
	1997		1998	
	Current	Mean	Current	Mean
90		1.494		1.461
120	2.833	1.841	3.033	1.850
150	4.867	2.446	4.984	2.480
180	4.100	2.722	3.800	2.700
210	0.217	2.364	0.250	2.350

Table 4. Average monthly meteorological data of Jorhat during the cropping period (1997 and 1998)

Month	Rainfall (mm)		Temperature (°C)				Sunshine hours		Relative humidity (%)			
	1997	1998	Maximum		Minimum		1997	1998	Morning		Evening	
			1997	1998	1997	1998			1997	1998	1997	1998
January	4.0	11.9	22.2	24.0	9.4	9.2	5.9	8.0	96	96	54	51
February	28.2	36.5	22.4	26.1	12.4	13.2	4.4	7.7	95	94	59	50
March	71.3	133.0	26.4	25.6	18.2	16.2	5.0	5.2	92	95	60	61
April	165.4	279.6	27.2	27.9	19.9	19.4	6.2	6.6	92	92	68	67
May	186.5	137.7	30.4	30.1	22.3	22.1	6.1	6.9	92	91	64	68
June	258.5	398.0	31.0	32.7	24.6	25.3	4.1	5.2	93	90	73	73
July	505.7	390.7	31.0	31.5	24.9	25.5	3.0	4.4	93	92	75	74
August	194.2	208.9	33.0	31.8	25.8	25.2	5.8	4.6	91	91	70	74
September	402.1	203.4	30.1	30.4	24.6	24.5	4.6	3.8	94	94	78	77
October	48.4	74.7	30.1	29.4	21.8	21.0	7.0	5.9	95	95	67	68
November	3.6	11.7	26.5	27.6	14.8	16.6	7.1	7.6	97	95	60	59
December	21.0	7.5	24.2	24.5	11.5	10.5	6.2	7.5	96	95	57	56

case of 180 days harvest time (Tables 2 and 3).

The time of harvest become largely a matter of yield economics. The stalk solids of kenaf increases with maturity (Clark and Wolff, 1969) and harvesting should be done after cessation of growth (Wood, 1981). During October–November kenaf started flowering and vegetative growth ceased at that stage (180 days) attaining maximum yield of biomass indicating appropriate stage of harvesting the crop (Sarma, 1990).

Correlation

Average monthly meteorological data of Jorhat during the cropping period of 1997 and 1998 are given in Table 4. The variations in yield of kenaf due to sowing and harvesting time are correlated to the meteorological parameters. The pre-monsoon sown crops get longer day-length, more temperature, rainfall and humidity, contributing to higher stem yield within short period. The increased plant height and diameter of kenaf sown in April could be attributed to the favourable climatic factors like rainfall, temperature, sunshine hours and humidity encountered by the crop during the grand period of growth resulting higher biomass yield (16.9 tonnes/ha) for both the years. Kenaf seeds may be sown in Assam during March–June

of the year to avail the advantages of warm-humid period and the agro-climatic conditions favourable for good growth and higher yield. Similar correlation was also established by Dutta and Fotedar (1979) and Muchow (1981) and Sarma (1990).

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