Castor (Ricinus communis L.) A Neglected Crop in Africa with Export Potential

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ABSTRACT

The castor-oil plant is an industrial crop which features prominently in international trade. Although the crop grows wild and seeds profusely in the tropics, production in Africa is very low.

Experiments were conducted in two seasons to study the effects of applying 0, 33, and 66kg/ha NPK, each at three spacing of 1 x 0.3m, 1 x 0.6m, and 1 x 0.9m on growth and yield of two wild growing varieties - Red stemmed and Green stemmed varieties. Fertilizer application did not increase yield in the Red variety nor in the Green variety; doubling the amount of fertilizer from 33 to 66kg/ha NPK depressed yield. Oil content of the seed was 52.1% and 38.2% in the Green and Red varieties respectively and oil yield was not affected by fertilizer application especially in the Red variety. The 1 x 0.6m spacing was optimum for both varieties.

KEYWORDS: castor, fertilizer, world trade spacing.

INTRODUCTION

The castor-oil plant grows wild in many tropical countries. It seeds profusely and quickly colonizes suitable habitats such as abandoned refuse sites. Castor may also be seen growing in compounds and as a hedge around farms. Fig.1 shows some wild growing castor plants on the UST campus. According to Weiss [5] a considerable increase in seed export could be quickly achieved if there was sufficient incentive to harvest the wild growing castor crops. The crop is of ancient importance. The seed is said to have been an important item of commerce in ancient Egypt and has been found in

tombs dating around 4,000 B.C. (Weiss) [5]. According to Weiss [5] about 10% of imported castor seed or oil is used in paints and varnishes, 5% in lubricating and similar oils, 5% as fatty acids, small amounts medicinally and the rest is used in industry for undefined products.

Export and import figures of castor seed and oil in world trade as given by FAO for 1987 are shown in Table I. It can be deduced from the table that trading in castor is not important to most African countries. It is also evident that the industrialized nations import castor as the bean, or more importantly, as the oil. Brazil imports a fair amount of beans for processing to become the leading exporter of castor-oil. Indian and Brazilian governments presently forbid the export of castor seed, which must be crushed domestically for the fertilizer value of the meal (Weiss [5]).

The wild growing castor now seeds profusely and quickly colonizes abandoned land and can be harvested for export. This will create enough incentive to cultivate the crop. It was in the light of this that we undertook to investigate the effect of fertilizer application and spacing on the growth and yield of two wild growing local varieties of castor.

Table 1: Castor in World Trade

Castor Bean and Oil: Exports and Imports in 1987

Castor Bean				Castor Oil			
Exporting Country	Amt (MT)	Importing Country	Amt	Exporting Country	Amt (MT)	Importing Country	Amt
AFRICA	4,500	AFRICA	126	S. AMER	82,418	AFRICA	2,767
Kenya	3,700	Zimbabwe	90	Brazil	81,310	S. Africa	1,700
Ethiopia	350	S. AMERICA	47,938	Ecuador	1,108	U.S.A.	42,527
Tanzania	400	Argentina	1,200	ASIA	71,096	Japan	2,248
S. AMERICA	14,003	Brazil	46,738	China	23,210	Turkey	3,484
Paraguay	14,000	ASIA	48,801	India	39,000	France	47,686
ASIA	133,776	China	3,200	Thailand	8,200	W. Germany	10,435
China	126,600	Japan	40,351	EUROPE	10,571	Italy	2,119
EUROPE	209	Korea Rep.	1,733	Bel-Lux	91	Netherlands	3,758
Belgium Lux	185	Thailand	2,000	France	215	Poland	4,800
		EUROPE	51,726	W. Germany	5,534	Spain	2,788
		W. Germany	38,091	Italy	1,816	Sweden	1,753
		Italy	10,889	Netherlands	2,226	Switzerland	1,545

Source: FAO Trade Yearbook, Vol 41 : 1987

MATERIALS AND METHODS

Two experiments involving two local varieties (Red-stemmed and Green-stemmed) were conducted in 1983 and 1984 at the Arable Crops Research Farm of UST, Kumasi, in the humid forest zone of Ghana. The experimental design was split-plot in a randomized complete block, with fertilizer treatment as the mainplot, variety as the sub-plot and spacing as the sub-sub-plot. Two levels of NPK fertilizer application and a control were investigated, viz 0, 33 and 66kg/ha. The three spacings adopted were 1 x 0.3m, 1 x 0.6m and 1 x 0.9m. The result of the soil analysis for the site was as follows:

Organic matter - 1.8%, available N, P and K were 134.9, 57.8 and 118.8kg/ha respectively.

In the first year of the experiment it was sown on 21st March, 1983. Two weeks after emergence it was thinned to one plant per stand. Data were collected on the following:

Stem height at first branching, number of days from sowing to 50% flowering, mean number of racemes per plant, the length of the pistillate portion of the raceme, the mean number of capsules/plant, mean capsule weight per plant, seed yield (kg/ha) and oil yield (kg/ha). Oil yield was studied on a sub-plot basis (ie. the effect of spacing was not considered). The oil was extracted by the solvent extraction method using hexane as the solvent.

The experiment was repeated in 1984 in an adjacent field which had similar soil properties as the first experiment.

RESULTS AND DISCUSSION

The means of the fertilizer and spacing effects are summarized in Tables 2 and 3 respectively.

1. Plant height at first branching. In the Euphorbiaceae, to which castor and cassava belong, branching habit is closely related to flowering. Flowers develop wherever a branch is formed. Statistically significant differences in height of branching were established between the two varieties. These were 197.0cm and 137.0cm tall in the Green and the Red varieties respectively. The local varieties are generally too tall. For commercial production, dwarf varieties may be desirable. Fertilizer application did not have any significant effect on this trait and there was no clear trend. The tallest plants were obtained at the 1 x 0.6m spacing in the Red [variety but] with the Green variety the height increased with increase in intra-row spacing. The differences were statistically significant, but the height of the Green variety in Experiment I at 1 x 0.6m is probably anomalous.

Table 2: The Effect of NPK Fertilizer on two Varieties of Castor

Character		Red Variety Fertilizer Level (kg/ha)			Green Variety Fertilizer Level (kg/ha)			
Character	Expt.	0	33	66	0	33	66	LSD 5%
Plant	I	99.5	85.2	83.1	115.6	115.8	92.9	42.6
Height (cms)	II	128.3	142.8	140.6	215.0	183.7	193.9	125.6
Days to	I	139	139	139	151	145	145	9
Maturity	II	136	135	133	146	139	132	12
No. of racemes	I	3.0	2.0	2.1	1.8	3.0	2.0	2.3
per plant	II	2.3	2.6	3.3	1.5	2.1	3.5	2.3
Length of Pistillate	I	13.0	10.9	12.1	11.0	13.5	13.4	5.8
Portion (cm)	II	9.6	8.5	9.3	8.2	8.1	9.2	6.2
No. of capsules	I	47.2	37.3	33.1	28.5	44.9	33.7	32.1
per plant	II	53.0	46.0	42.0	25.1	48.9	47.4	47.6
Capsule Yield	I	65.4	54.5	50.8	46.3	77.2	62.7	50.3
per plant (gms)	II	80.1	65.2	64.0	43.0	89.8	71.5	51.2
Seed Yield	I	879.8	530.3	765.5	765.5	1137.7	1062.5	1788.3
(kg/ha)	II	1084.5	856.7	980.4	814.9	1273.5	1308.8	1618.0
Oil Yield	I	298.9	403.0	261.4	421.1	453.6	450.1	50.8
(kg/ha)	II	285.8	502.7	418.3	495.5	499.2	570.7	108.7

Table 3: The Effect of Spacing on two varieties of Castor

	Red Variety Intra-Row Spacing (cms)				Green Variety Intra-Row Spacing (cms)			LSD 5%
Character	Expt.	30	60	90	30	60	90	
Plant	I	55.7	142.3	69.7	117.1	61.3	145.9	44.3
Height (cms)	II	112.4	201.6	97.6	121.0	158.0	313.5	66.0
Days to	I	141	146	131	156	134	151	14
Maturity	II	142	140	156	144	132	142	15
No. of Racemes	I	2.1	2.2	2.8	1.4	3.0	2.5	1.8
per plant	II	2.4	2.8	2.9	1.4	3.6	2.0	0.5
Length of Pistillate	I	12.6	10	13.4	7.3	21.1	9.6	6.3
Portion (cms)	II	9.5	7.8	10.1	6.9	10.3	8.2	3.0
No. of Capsules	I	39.3	17.4	61.1	16.2	72.2	18.7	34.5
per plant	II	44.8	20.4	75.9	13.2	81.2	26.8	31.4
Wt. of Capsules	I	45.2	57.8	67.7	40.2	81.5	64.5	45.1
per plant (gms)	II	54.8	71.1	82.4	44.4	90.1	69.8	38.3
Seed	I	703.5	952.0	520.0	1151.1	1164.2	650.3	342.8
Yield (kg/ha)	II	931.6	1280.7	709.3	1208.0	1341.3	847.2	507.1

2. Number of days to flowering: The Red variety was slightly earlier than the Green variety. They flowered in 135 and 139 days respectively. Some plants however, flowered at 116 days. This is an indication of the genetic variation that exists in these varieties, which may be exploited to develop early maturing varieties, to replace the perennial and late maturing types. Fertilizer application reduced the number of days to flowering by 6 days in the Green variety but had no effect on the Red variety. Fernado [2] also found that in Sri Lanka, plants given manure matured significantly earlier than unmanured ones.

Spacing significantly affected earliness to flowering and plants generally flowered earlier at the wider spacing. Weiss [4] also reported that in Brazil, close spacing tended to delay maturity. This may be explained by the fact that at the wider spacings, there is less competition and so plants produce branches earlier normally accompanied with infloresence developing at such points.

3. Yield and its components

i) Length of the pistillate portion of the raceme: The mean length was 12 and 12.7cm in the Red and Green varieties respectively. But there was a tremendous variation in both varieties indicating here again the high potential for

The results of other fertilizer trials agree with our findings. For example, El-Hamidi et al [1] found fertilizers to have no effect on yield or individual seed weight in trials in Egypt. Zimmerman [6] also concluded in his review that castor is not a crop for poor land but very fertile soils produce a rank vegetative growth. According to Weiss [4] it has been estimated that a 1700kg/ha seed yield removes the equivalent of 50kgN, 20kgP and 16kgK per ha, excluding that which is in the plants themselves. The soil analysis for this work gave 134.9KgN, 57.8KgP and 118KgK/ha. These amounts therefore appeared sufficient for the plants, and hence the lack of response to additional fertilizer. Spacing had a highly significant effect on seed yield in both experiments. An increase in the intra-row spacing from 30cm to 60cm, increased seed yield but a further increase to 90cm sharply reduced yield to the lowest level for the two varieties in both experiments. Godin and Spensley [3] also reported that in India, the annual varieties have been found to give good yields at 90 x 60cm. Weiss [4] also stated that in Argentina 1 x 0.6m or 1 x 0.5m are good spacing for local annual types and 1 x 0.4m for introduced dwarf hybrids.

iv) Castor-oil yield: The oil content of the seed was higher in the Green variety than in the Red. Oil contents were 52.1% and 38.2% in the Green and Red varieties respectively and total oil yield was generally higher in the Green variety as can be seen in Table 4. In the Red variety, the highest response to fertilizer was obtained at 33kg/ha NPK. Increasing fertilizer level to 66kg/ha reduced oil yield in both experiments. The response was slightly different in the Green variety where the different levels appeared not to nave any effect on oil yield. Weiss [4] in his review also concluded that fertilizer application in general have little effect on oil yields.

CONCLUSION

Castor grows wild in many African countries and there is a flourishing international trade in the crop. The local varieties appear to be unresponsive to high levels of soil fertility, and yet they seed profusely and give reasonable yields. The results of this work therefore agree with Weiss [5] that considerable seed production could be quickly achieved if there was sufficient incentive to harvest the wild growing crop. When interest has been generated in the crop to the point of cultivation, and respond to higher levels of soil fertility, and closer spacings would have to be developed.

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