Cassava Selections for the Republic of Zaire

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Abstract

Cassava production in Zaire is threatened by three major diseases and two very serious pests resulting in part, to reduced yield since 1972. Presented is the progress made in selecting high yielding resistant clones as well as factors to consider in selecting for high root and leaf yielding cassava since cassava is an important crop in Zaire.

Introduction

Annual cassava production in the Republic of Zaire is estimated at 11 million tons per one million hectares of land. The 1970 average of 11 tons/ha, if reliable is higher than the 1970 average for Africa (7.5 tons/ha), the 1967 average for Asia (8.5 tons/ha) but is lower than the 1970 average for Latin America (13.6 tons/ha). Recent surveys and results from experimental plots, showed that yields have been declining very rapidly. This is attributed to several factors some of which include:

(a) The use of unimproved cassava varieties which are susceptible to diseases and pests;

(b) The high incidence of three main diseases (cassava mosaic, cassava bacterial blight and cassava anthracnose) and two major pests (the cassava mealybug and the cassava green mite);

(c) Poor extension services resulting in lack of adequate information on improved cultural practices including time of planting, weeding, choice of sites and soil improvement practices.

Of great importance is transportation services and favorable marketing policies which could encourage farmers to produce more cassava.

This paper reviews progress made in recent years in the improvement of cassava in Zaire. This was essentially due to efforts of the Programme National Manioc (PRONAM), a co-operative research project between the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria and the Government of Zaire.

Changes in Cassava Root Yield in Zaire (1972-76)

Declining trend in cassava root yield has been observed at M'vuazi river valley, an alluvial soil deposit of the M'vuazi river, as illustrated from yield distribution of over 145 clones assembled at the M'vuazi Station. Fig. 1

In the 1972/73 season, about 9% of these clones yielded up to 32 tons/ha fresh root (under experimental conditions) with the highest frequency in the 16 tons/ha range. Between 1974 and 1976, the highest yielding clones (1% and 5% respectively) were in the 20 to 24 tons/ha range. High disease (CMD, CBB and Anthracnose) and pest (mainly mealybug) incidence are considered the major factors causing production decline although drastic weather changes as exemplified by a seven month drought in 1975/76 which favored mealybug attack in Bas, Zaire, might be important. Research on cassava selection to reverse this trend was started by PRONAM in 1975.

Seed introduction. Several thousands of improved seeds were supplied to PRONAM by IITA during 1975, 1976, 1977 and 1978. These were established and evaluated at several locations of diverse ecological conditions in Zaire. Seedlings selected for disease and pest resistance were cloned and evaluated for yield and stability in resistance to the prevailing disease and pest problems.

Yield Distribution of Cassava Selections at Different Sites

Data in Table 1 show that except in areas dominated by the Kalahari sands (described as Sandy Savannah), yields of about 4.8 kg/plant were harvested from some selections at the preliminary yield trial phase. Selections from PYT (unreplicated) were further evaluated in four replicates.

Advanced yield trials. The relative performance of the best clones from three locations were used to show the performance of IITA PRONAM Selections (Tables 2, 3 and 4). At the M'vuazi valley, a rich alluvial area, AYT yields at 11 months ranged from 48.5 tons/ha fresh root for 30344/8 to 17.3 for 30697/272. The local control yielded 17.2 t/ha fresh root. In the Vanga area, only two selections yielded about 1½ times the local control. CMD and CBB were generally mild while anthracnose was serious in this area. Under severe growing conditions at Lowa (an area dominated by Kalahari sand) all improved selections yielded from about 2 to almost 4 times the local control at 11 months. CMD severity seemed not to be related to yield. Most of the selected clones for Lowa are resistant to CBB and Anthracnose **(Table 4).**

Cassava vigor in relation to major diseases. Cassava leaf is an important vegetable in Zaire, therefore leaf yield for selections meant for farmers' adoption must be considered. Serious attack by anthracnose significantly reduced elongation of cassava branches and leaf retention of some 105 clones at six months (Table 5). Growth of the primary branch was unaffected by severe anthracnose incidence but leaf number was reduced by 40%. Severe CMD attack reduced elongation of young branches (those above tertiary) by 31%. A small increase in leaf number (7%) was associated with CMD infection (Class 4 and 5). Many of these leaves were small and poorly developed compared with those in Class II rating for CMD.

Pattern of leaf development of seven cassava cultivars. Shortages of cassava leaves as vegetables are usually experienced during the dry season which starts in mid May in Bas, Zaire. Drastic losses of cassava leaves due to drought are observed. Leaf loss for 02864 from May 12 to July 30 was about 80% while a popular local variety the Mpelolongi lost only 36% of its leaf during dry season, explaining in part, its popularity in spite of low average root yields (about 12 tons/ha). The PRONAM clones lost between 25 to 61% of their leaves during the same period (with 30083/18 losing the least) suggesting some

tolerance to moisture stress (Fig. 2)

Average area per leaf of the Mpelolongi (ML), a popular local variety in Baz, Zaire, approaches 720 cm^2 when fully expanded. This is higher than the areas of all improved clones which range from about 300 cm^2 to 460 cm^2. Leaf life ranged from only 30 days for clone 30173/18 to 60 days for 02864. Irrespective of cultivar, leaf expansion during dry season stops after about 18 days (Fig. 3)

Plant vigor as a selection criterion for yield. Plant vigor is an important criterion for selecting for high root yield. The yield distribution of some 770 clones (PYT), show that average root yield of plants in vigor class I in "1–5" scale was about 800 g per plant while mean yield of those in class II was about 600 g and for class 5, only 400 g per plant (Fig. 4). Vigor alone does not, however, determine yield as shown in classification of individual plants within each score class of 7 yield groups of less than 0.4 kg/plant to more than 2.4 kg per plant. While some plants in vigor class 1 and 2 yielded more than 2.4 kg, plants yielding up to 2.9 kg/plant are available in vigor classes 3, 4 and 5 (Fig. 5).

SUMMARY

Ample opportunity exists for selection of cassava cultivars resistant to the prevailing diseases in Zaire and which will double or triple root yields currently obtained. Depending upon sites, yield increases from improved cultivars ranged from 50% to over 300%. The performance of the selected clones on farmers' fields and the stability of their resistance to diseases were examined. Cassava selections for adoption by farmers must not only produce high root yields but should produce high leaves of acceptable quality especially during dry seasons. Studies and cultural practices to strike a balance between these two conflicting yield variables (high leaf yield *vs* high root yield) are recommended.

Table 1. Yield Distribution of Manioc Clones at Different Sites in Zaire (Yield Kg/Pl. PYT).

SITE	YIELD RANGE KG/PL 1.6	1.6- 3.2	3.2- 4.8	4.8- 6.0	6.0	TOTAL FREQ.	CONTR. KG/PL
RIVER VALLEY			PERCENT FREQUENCY				
ALLUVIAL (4)+	64.8	20.6	9.0	3.5	2.2	5612	1.76
SHRUB + GRASS DEEP TOP SOIL (4)	60.6	27.2	7.2	3.4	1.7	2452	1.86
DERIVED SAVANNAH(2)	81.6	13.1	4.8	0.5		1926	1.11
FOREST (2)	83.0	13.7	3.4	0.2		708	2.49
SANDY SAV. (2)	100.0	-	-	-		1260	0.33

+Denotes no. of sites

Table 2. Relative performance of some AYT selections at M'vuazi

Clone	T/ha Fresh root 1976/77 (11 months)	% Dry Matter	Tons/ha Dry Wt.	% Starch	Disease ratings (6 months) CMD	CBB	A	% Lodg.	Tons/ha Fresh PYT 1975/76
30344/8	48.5	30.7	14.9	23.9	2	2	3	30	25.6
F 154	43.5	27.2	11.8	20.9	3	3	2	25	21.7
30070/4	34.9	31.7	11.1	24.8	2	2	2	20	21.0
02864	30.8	32.6	10.0	25.6	3	3	2	30	24.7
30174/2	33.9	29.3	9.9	22.7	3	2	4	40	30.0
30225/1	30.1	32.0	9.6	25.0	2	2	2	10	20.2
30122/2	25.9	31.8	8.5	24.9	2	1	2	30	33.7
30122/3	24.8	34.3	8.5	27.0	1	2	2	20	18.0
30294/6	24.2	34.1	8.2	26.9	3	3	1	10	26.0
30429/7	23.8	33.0	7.9	25.9	3	3	2	0	20.1
30399/5	22.0	34.0	7.6	26.8	3	3	2	90	25.2
30344/6	21.3	35.0	7.5	27.6	2	2	2	40	48.6
F 45	24.7	29.5	7.3	22.8	3	3	3	40	26.8
30008/2	23.7	29.9	7.1	23.2	2	3	3	80	27.5
30213/5	20.3	34.7	7.0	27.4	2	3	3	10	14.2
F 120	19.8	34.4	6.8	27.1	3	2	3	25	18.3
30697/272	17.3	39.1	6.8	31.2	2	2	2	10	26.4
30280/3	22.0	30.7	6.8	23.9	2	3	2	50	23.3
30280/4	21.6	32.4	6.8	25.4	3	3	3	40	25.5
30070/2	20.4	33.0	6.7	25.9	2	2	3	35	30.0
LSD 0.05	16.99		4.45						
CV %	30.0		24.6						

Table 3. Relative performance of AYT selections at Vanga (Forest to Derived Savannah)

Clone	Tons/ha Fresh root (11 months)	Disease Scores at 6 Months CMD	CBB	Anthracnose
30454/11	40.0 (152)	2	2	3
30957/1	37.8 (144)	2	2	3
30011/10	33.3 (127)	3	2	4
30278/2	29.2 (111)	2	2	2
30009/8	29.2 (111)	1	3	2
30952/4	28.5 (108)	4	2	2
30014/1	28.3 (107)	3	2	4
30770/1	28.3 (107)	2	3	4
30578/2	28.0 (106)	3	2	2
A 86	25.8 (106)	3	2	4
30009/1	25.7 (98)	1	2	2
30085/8	25.5 (97)	5	1	3
30173/2	25.4 (97)	2	2	5
30737/4	24.5 (93)	3	2	2
30578/6	24.0 (91)	3	2	4
30957/6	23.5 (89)	2	2	3
30010/7	23.2 (88)	3	2	3
30014/6	22.8 (87)	3	2	3
30018/18	22.8 (87)	3	2	4
30578/7	22.8 (87)	3	2	3
Local	26.3 (100)	3	2	4

LSD 0.05 9.78
CV (%) 17
*Denotes % Control

Table 4. Relative performance of AYT selected clones at Lowa.

Clone	Tons/Ha Fresh Root (11 months)		Disease Scores (6 months) CMD	CBB	Anthr.	Vigor
30081/9	11.6	(283)*	2	2	1	3
30085/8	11.7	(285)	3	2	2	2
30089/18	8.0	(195)	5	1	3	3
30093/6	16.2	(395)	2	2	1	2
30093/15	11.5	(280)	3	1	2	3
30093/16	8.8	(215)	2	2	2	3
30260/6	9.9	(241)	5	1	1	2
30280/16	10.0	(244)	3	2	1	2
20294/15	9.4	(229)	4	2	2	2
30983/7	14.9	(363)	2	1	1	3
Local	4.1	(100)	3	2	2	4
LSD	7.17					
CV (%)	30					

*Denotes % Control

Table 5. Anthracnose and CMD severity in relation to cassava vigor.

Vigor Parameter	Rating Class	Entries	Mean	t 0.05	% Class II Class IV & V
		Anthracnose			
Plant Height (cm)	II	47	230	0.38	93.5
	IV + V	58	246		
Length Tertiary Branch (cm)	II	47	1118	3.58**	130
	IV + V	58	806		
Length 4° and other Branches (cm)	II	47	472	4.93**	254
	IV + V	58	186		
Leaf No.	II	47	295	3.15**	166
	IV + V	58	178		
		CMD			
Plant Height (cm)	II	50	239	0.72	103
	IV + V	21	231		
Length Tertiary Branch (cm)	II	50	941	1.48	112
	IV + V	21	837		
Length 4° and other Branches (cm)	II	50	272	2.36*	145
	IV + V	21	187		
Leaf No.	II	50	182	0.87	93
	IV + V	21	195		

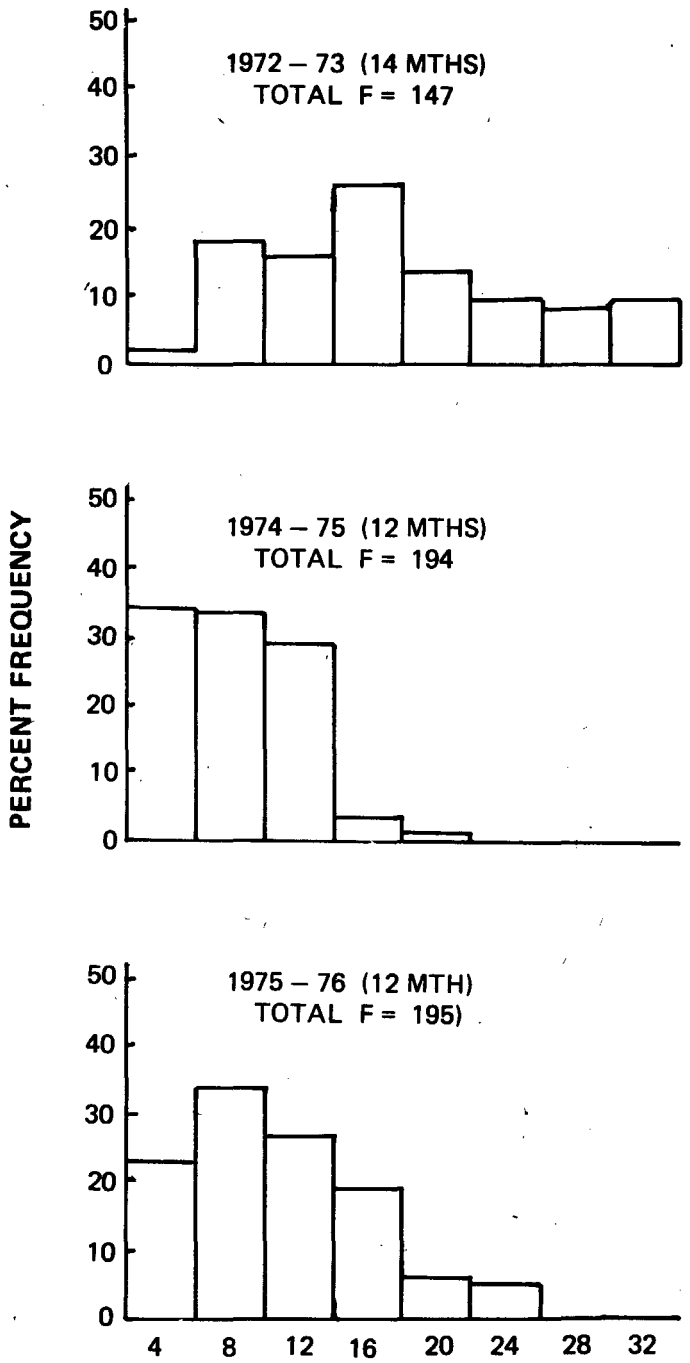


Fig. 1. Fresh Rootyield, T/Ha.

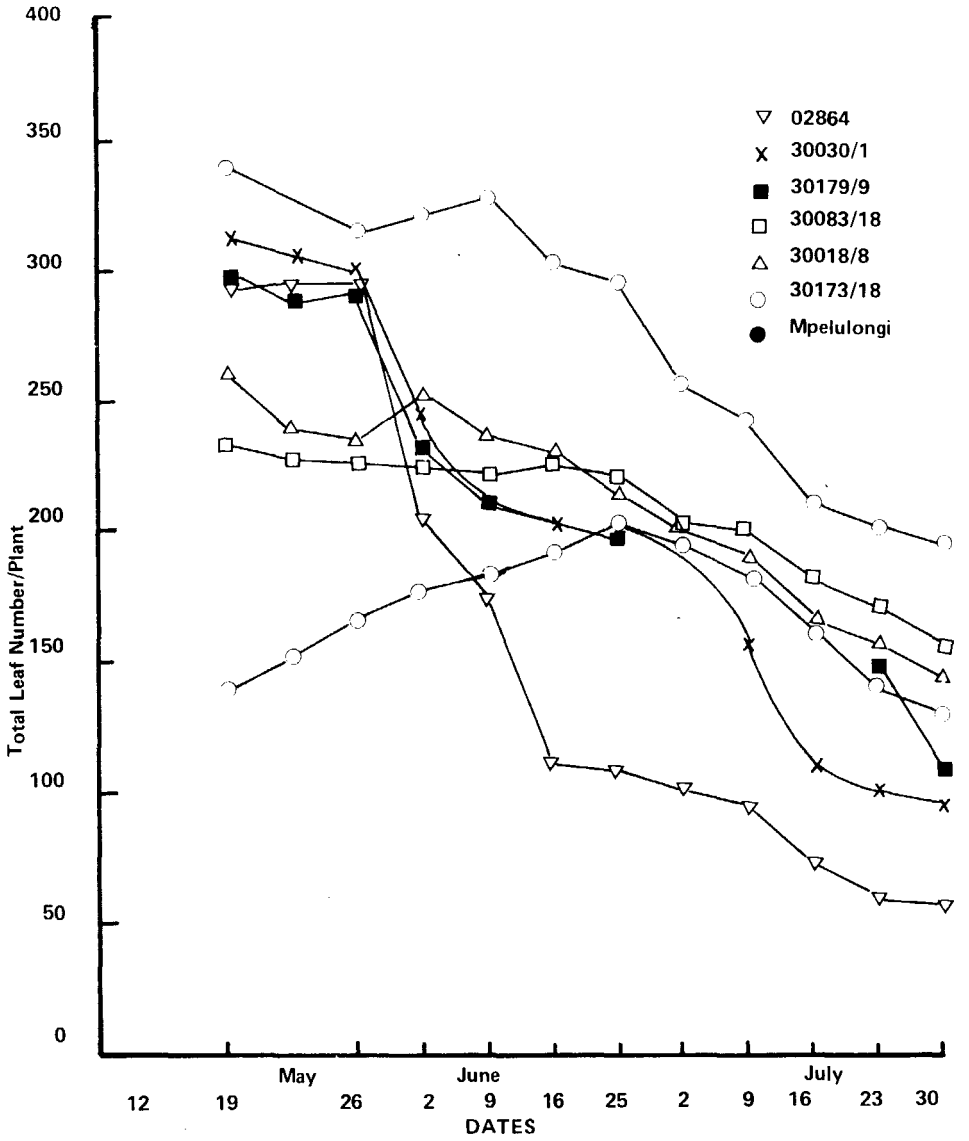
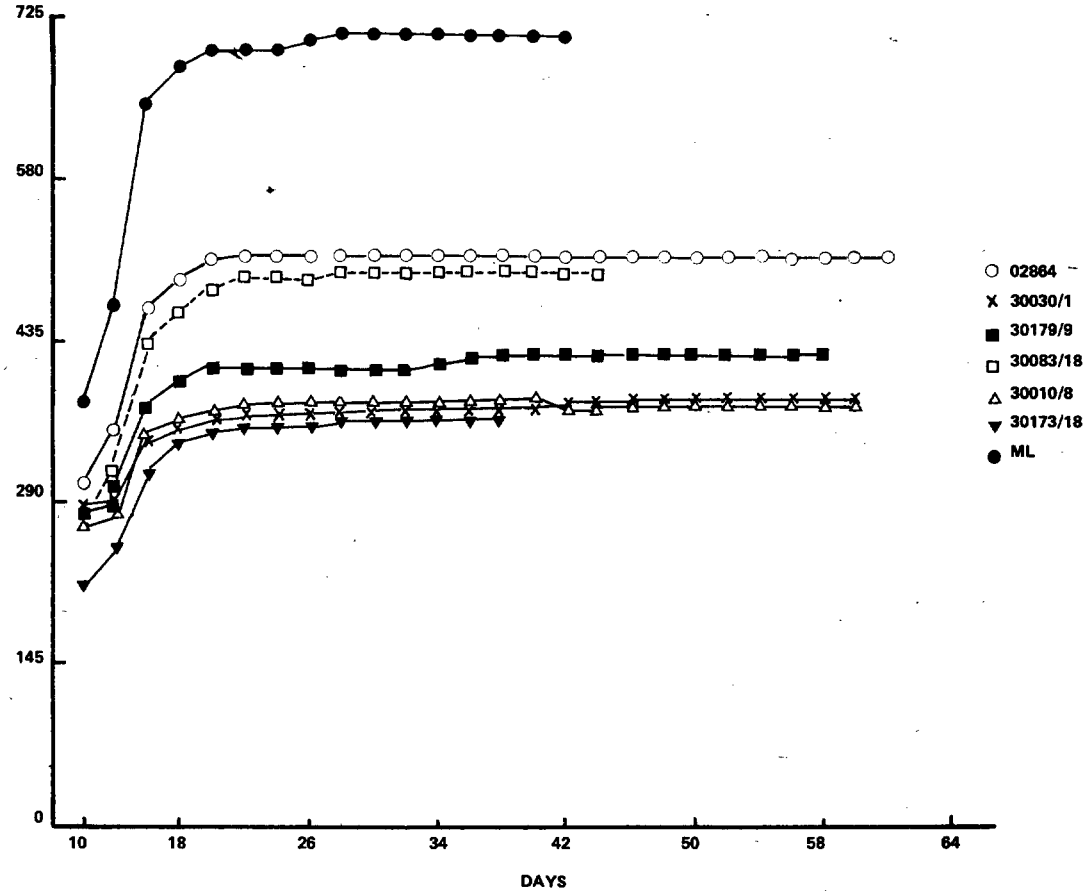


Figure 2. Pattern of leaf development of seven cassava cultivars: leaf number during dry season

Figure 3. Pattern of leaf development of seven cassava cultivars: Area/Leaf and duration in dry season



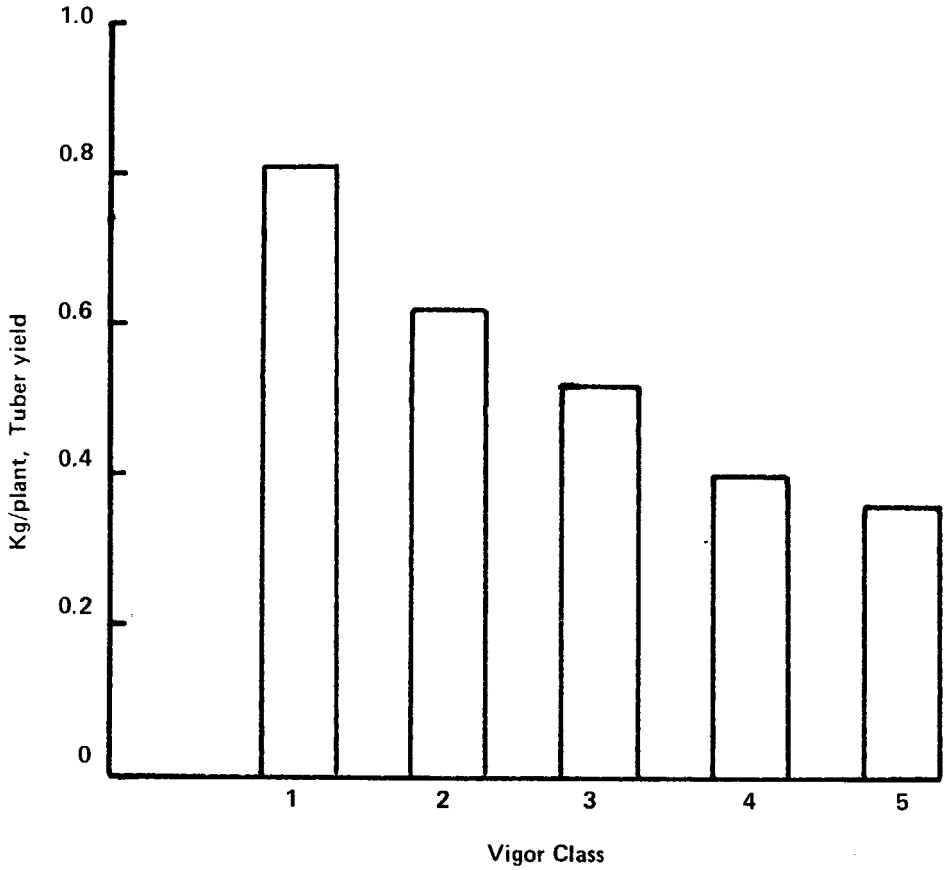
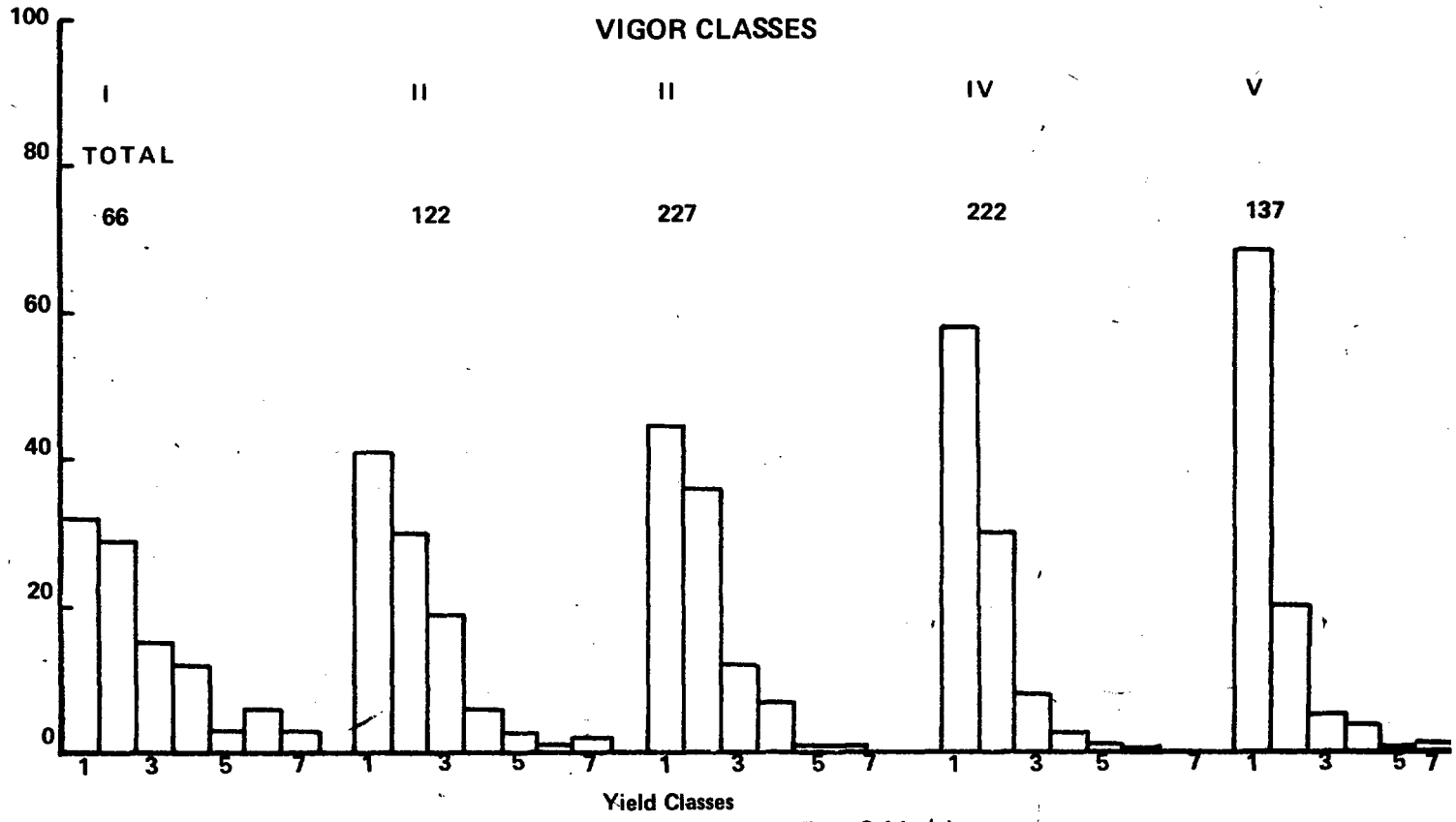


Fig. 4. Average yield per clone at Kimpese in relation to vigor rating (1 most vigorous; 5 least)



CL 1 = 0.4 kg/pl, CL 2 = 0.4-0.8 kg/pl at increments of 0.4 kg to class 7 = 2.4 kg/pl.

Fig. 5. Relationship of vigor with yield (kg/plant)