

ENVIRONMENTALLY FRIENDLY WEED CONTROL IN YAM-BASED CROPPING SYSTEM USING PLANOPHYLLS IN S.E. NIGERIA

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ABSTRACT:

A researcher- managed on-farm trial involving the evaluation of four low growing crops (planophylls) for use in weed control in yam/maize/cassava intercropping system was carried out in Awka, Anambra state and Abakaliki, Ebonyi state, Nigeria in 2003. The four planophylls, egusi-melon, sweet potato, groundnut and vegetable cowpea ("akidi"), were compared with farmers practice of three hand weedings and a weedy check. Generally, the results showed that yam, maize and cassava were depressed by zero weeding. Yam, maize and cassava yields were similar among the low growing crops and between low growing crops as weed control practice and three hand weedings. Partial budget analysis showed that all weed control measures were more profitable than the weedy check. Since the presence of these low growing crops (egusi-melon, sweet potato, groundnut and vegetable cowpea) did not depress component crops yields, they are therefore recommended for use by farmers to control weeds in their yam/maize/cassava farms.

Key Words: On-farm Research, Intercropping, Weed control, Planophyll

INTRODUCTION

Nigeria is the largest producer of yam accounting for 75% of its production world wide (FAO, 2005). Yams provide food for over 60m people in Nigeria (Nweke *et. al* 1991), yet yam production in Nigeria is constrained by many problems one of which is weed control. This is particularly so in S.E. Nigeria, where the rainfall pattern encourages rapid weed growth. Therefore weed control is an integral part of crop management. To keep a crop mixture completely weed free is difficult and not economically advantageous (Zimdahl, 1980). There is, for every crop or crop mixture, the critical period of weed interference. That is, period during which weed association with crop plants significantly reduce final crop yields (IITA, 1974).

The critical period for weed interference in cassava/maize intercrop is 4-8 weeks after planting WAP (Unamma and Ene, 1983) and 8-18 WAP for ware yams (Unamma, 1981). Weed infestation is a major problem in crop production in S.E. Nigeria, (Unamma *et al.*, 1985), where hand weeding is the major weed control method. Though hand weeding is effective, if done timely, it is tedious and costly. Use of chemicals is an alternative method, but the recommended chemicals are not readily available and where available are out of the reach of resource poor farmers. Moreover, the application hazards, techniques and residual effects also militate against their use.

Unamma *et al.* (1985, 1986) and Anuebunwa (1991) have reported that egusi-melon and grain cowpea used as weed control measure in yam/maize/cassava intercropping was cost effective. But in most parts of SE. Agro-ecological zone, the time of planting cowpea does not synchronize with the time of planting of yam, which is the base crop, thereby making this low input technology not feasible. However, there are other low growing crops in the cropping system of these areas which could be substituted for egusi-melon and cowpea. There is the need, therefore, to evaluate some indigenous low growing crops for use as weed control measure in Yam/Maize/Cassava intercrop.

MATERIALS AND METHODS

The researcher-managed on-farm trial was conducted in Awka (Anambra state) and Abakaliki (Ebonyi state) in 2003. In Awka, the experimental sites were under 4-year fallow after a yam/maize/cassava intercrop, while in Abakaliki the land fallowed for two years after yam/maize/intercrop. The test cropping system was yam/maize/cassava alternate row intercropping. The treatments included four low growing crops, egusi-melon at 40,000/ha, sweet potato at 20,000/ha, groundnut at 80,000/ha and vegetable cowpea (*Vigna unguiculata* sub spp *dekintiana* locally called 'akidi') at 80,000/ha), 3 hand weedings (at 4, 8 and 12 WAP) and a weedy check. All treatments, except the weedy check, were weeded at 4 weeks after planting (WAP). The treatments were laid out in a randomized complete design in four replications (farms) within two locations (Awka and Abakaliki).

Cassava variety, TMS 30572, was planted at 200cm x 50cm (10,000 plants/ha) on the crest of the ridges and 200g yam (cultivar-Obiaturugo) was also planted at 200cm x 50cm (10,000 plant/ha) on the crest of ridges so that yam row alternated with that of cassava at 1.0m apart. Two maize seeds/hole (variety TZSR-Y) were planted at 100cm x 100cm (20,000 plants/ha) at the base of the ridges. Egusi-melon was planted at 50cm x 100cm (2 seeds/hole=40,000/ha) midway on one side of the ridge. Three-node-cuttings of sweet potato were planted at 30cm x 100cm (33,000 plants/ha) on the crest of ridges such that three stands of sweet potato alternated with one yam or one cassava stand along the ridge. Groundnut and vegetable cowpea were each planted at 100cm x 25cm and two seeds per hole (80,000 plants/ha) on one side of the ridge.

Maize, yam and cassava were harvested at 4, 6 and 12 months after planting (MAP), respectively, while egusi-melon, sweet potato and groundnut were harvested at 3 MAP. Fresh vegetable cowpea pods were harvested piece-meal as they mature and total weight recorded.

Weed weight per plot was determined at 10 WAP by harvesting all the weeds enclosed in a 100cm x 100cm quadrant. Sub-samples of the total fresh weed weight per plot were oven dried to constant weight. This was used to estimate the total dry weed weight per hectare.

Individual state and combined state-wise analyses were done using analysis of variance (Gomez and Gomez, 1983) and the means compared using Duncan's Multiple Range Test (DMRT) (Obi, 1995). Total revenue was computed for each treatment using farm-gate prices of each produce. Partial budget analysis was employed in decision making.

RESULTS AND DISCUSSION

Weed Weight

There were significant differences in the ability of the various low growing crops to control weeds both in the individual locations and pooled mean basis as measured by the weed weight (Table 1). In Awka, Anambra state, use of egusi-melon, vegetable cowpea and sweet potato had similar weed weight as the two extra hand weeding treatments. Groundnut had the highest weed weight among the weed control measures. In Abakaliki, vegetable cowpea had the least weed weight. On pooled mean basis, again treatments with vegetable cowpea had the least weed weight. The less the weed weight, the greater the ability to control weeds. Therefore, vegetable cowpea followed by 2 extra hand weedings and then egusi-melon in that order were the most effective in weed control. Udealor (2002) showed that weed weight decreased when vegetable cowpea was intercropped with cassava, especially when it was planted at 60,000 80,000 plants/ha.

Use of Planophylls for weed control

Table 1: Effect of low growing crops on the mean weed weight (t/ha) in Awka and Abakaliki
Weed Weight (t/ha)

Treatment	Awka	Abakaliki	Pooled mean
Yam/Maize/Cassava + Egusi-melon	0.20 ^c	0.28 ^b	0.24 ^{cd}
Yam/Maize/Cassava + Sweet potato	0.29 ^{bc}	0.26 ^b	0.28 ^c
Yam/Maize/Cassava + Groundnut	0.35 ^b	0.30 ^b	0.33 ^b
Yam/Maize/Cassava + 'Akidi'	0.22 ^c	0.19 ^b	0.21 ^d
Yam/Maize/Cassava + weedy check	0.46 ^a	0.55 ^a	0.49 ^a
Yam/Maize/Cassava + 3 Hand weedings	0.20 ^c	0.25 ^b	0.23 ^{cd}

Means followed by the same letters are not significantly different as determined by DMRT at 5% level of probability.

Component Crop Yields

Table 2 shows the yields of the component crops. There were no significant differences in yam yield between plots weeded three times and those intercropped with low growing crops in both Awka and Abakaliki. Yam tuber yield did not also differ among the plots with the low growing crops. However, when compared with the weedy check, tuber yield of yam was higher in Awka by 113.0, 69.6, 95.6, and 121.7% by intercropping with egusi-melon, sweet potato, groundnut, vegetable cowpea and 3 hand weedings, respectively and while in Abakaliki by 70.5, 63.9, 85.0 and 54.1, respectively

In Awka, there were no significant differences in cassava root yields among the various low growing crops but when compared with three hand weedings results indicated that using egusi-melon, sweet potato, groundnut and vegetable cowpea significantly reduced root yield by 18.8, 22.5, 30.9 and 31.4%, respectively. In Abakaliki, using groundnut, sweet potato and egusi gave the highest but similar root yields. The weedy check gave significantly lower yields than the other weeded treatments. In both locations, plots weeded three times gave similar maize grain yields as those containing low growing crops. The weedy check reduced maize yield significantly ($p \leq 0.5$).

Table 2: Effect of the use of low growing crops for weed control on the yields of component of yam/maize/cassava intercrop in Anambra and Enugu states, Nigeria 1992.

Treatment	Yam (t/ha)			Cassava (t/ha)			Maize (t/ha)		
	AN	EN	Mean	AN	EN	Mean	AN	EN	Mean
Y/M/C + Egusi	4.9a	10.4a	7.7a	15.5a	15.2ab	15.4a	1.7a	1.3a	1.5b
Y/M/C + Sweet potato	3.9a	10.0a	7.0a	14.8a	15.3ab	15.1a	2.0a	0.7bc	1.7b
Y/M/C + Groundnut	4.5a	11.1a	7.8a	13.2ab	17.6a	15.4a	1.9a	1.5a	1.7b
Y/M/C + Akidi	3.9a	9.9a	6.9a	15.1b	13.5b	14.3a	2.0a	1.2ab	1.8b
Y/M/C (weedy check)	2.3b	6.1b	4.2b	9.1c	10.9c	10.0b	1.0b	0.5c	0.8c
Y/M/C+2 extra hand weedings.	5.1a	9.4a	7.3a	17.1a	14.9b	16.0a	2.5a	1.2ab	1.9b

LGC = Low growing crop: AN = Anambra; EN = Enugu

Means followed by the same letters in the same column are not significantly different as determined by DMRT at 5% level of probability.

Partial Budget Analysis

Table 2 shows the partial budget analysis. All weed control measures were more profitable than the weedy check. In Anambra state, the most profitable weed control measure for yam/maize/cassava was the use of egusi followed by Akidi as intercrop. These gave a net revenue of N59, 300/ha, N52, 820/ha and marginal rate of returns of 496.1% and 399.6%, respectively. In Enugu state sweet potato as a low growing intercrop gave the highest marginal rate of return of 949.4% even though egusi, groundnut and akidi were also all profitable.

Table 3: Partial budget analysis as affected by the use of low growing crops for weed control in yam/maize/cassava intercrop in South east Nigeria

Treatments	Gross field benefit (N/ha)		Total variable cost (N/ha)		Net benefit (N/ha)		Marginal rate of return (%)	
	AN	EN	AN	EN	AN	EN	AN	EN
Y/M/C/Egusi	65,100	91,280	5,800	5,800	85,480	59,300	571	476.9
Y/M/C/+sweet potato	61,160	120,570	6,500	6,500	114,070	54,660	949.4	353.2
Y/M/C/+Ground nut	59,540	56,930	5,750	5,750	91,180	53,790	675.1	385.2
Y/M/C/+vegetable cowpea	57,520	86,090	5,300	5,300	52,220	80,791	536.4	399.6
Y/M/C/+2 extra hand weeding	32,720	59,360	-	-	32,720	59,360	-	--
Y/M/C/(weedy check)	71,120	92,820	20,000	20,000	51,520	72,820	349.6	365.3

AN =Anambra state; EN = Enugu state. Y/M/C = Yam/Maize/Cassava

Farm gate prices (N/t) : Yam = 6000; cassava = 1,200; Maize = 8,000;Egusi = 140,000; groundnut = 20,000; Vegetable = 30,000; sweet potato = 5,000

The results obtained in this trial corroborated previous works on the use of low growing crops as weed control measure (Unamma *et al.* 1985, Anuebunwa, 1991). These planophylls provided high vegetative cover between 4-12 weeks after planting and suppressed weed growth. This early weed suppression was necessary for good crop growth since the critical period of weed interference in yam/maize/ intercrop lies within this period (Unamma *et al.* 1985). In addition to the weed control, these low growing crops provided additional harvests which will give the farmer another food variety.

The evaluated low growing crops (egusi-melon, sweet potato, groundnut and vegetable cowpea) are common in the farming systems of S.E. Ago-ecological zone of Nigeria, and results from this trial shows that their presence did not depress component crops yields we therefore recommend them for use by farmers to control weeds in their yam/maize/cassava farms.

REFERENCES

- Anuebunwa, F.O. (1991). Weed control in yam/maize/cassava intercrop for resource limited farmers. Nig. J. Weed Sci. 4: 63-69.
- IITA (1974). International Institute of Tropical Agriculture Annual Report, Ibadan, Nigeria. P.199
- Udealor, A. (2002). Studies on growth, yield, organic matter turn-over and soil nutrient changes in cassava (*Manihot esculenta* Crantz)/Vegetable cowpea (*Vigna unguiculata* L. Walp) mixture. Ph. D. Thesis. University of Nigeria, Nsukka, Nigeria p.167
- Unamma, R.P.A. (1981). Investigations on weed interference in white yam (*Dioscorea rotundata* Poir), Ph. D. Thesis. University of Ibadan, Nigeria.
- Unamma, R.P.A. and Ene, L.S.O. (1983). Critical period of weed interference in cassava/maize intercrops. In: Annual Report: National Root Crops Research Institute Umudike for 1983. pp 195-198.
- Unamma, R.P.A., L.S.O. Ene and Melifonwu, A. A. (1985). Weed interference and management in yam/maize intercrop under Tropical Rainforest condition in Nigeria. 7th Symposium International Society of Tropical Root Crops. Abstract. International Development Research Centre, Sands. P.150
- Unamma, R.P.A. Ene L.S.O. Odurukwe S.O. and Enyinnia, T. (1986). Integrated weed management for cassava intercropped with maize Weed Research. 26: 9-17.
- Zimdahl, R.L. (1980). Weed competition A Review, International plant protection centre. Corvallis, Oregon State University, Oregon. Pp.196