leaves must probably have elevated the gut pH beyond the favourable range resulting in inactivation of the released virions.

Yoshimitsu and Zhou (1988) also observed that the virions become inactivated when the NPV were treated with a saturated solution of calcium hydroxide and when the solution containing the inactivated virions was administered through per os into the healthy silkworms, no infection of the the larvae was observed. Patil (1991) also observed similar inactivation of polyhedra of cytoplasmic polyhedrosis virus (CPV) when treated with calcium hydroxide. From the studies, it may be concluded that leaf treatment with calcium hydroxide at 100 ppm fed once during the third instar reduces the grasserie disease.

REFERENCES

ABBOTT, W. S. (1925). A method of computing the effectiveness of an insecticide. **J.Econ. Entomol., 18:** 265-267

IGNOFFO, C.M. and GARCIA, C. (1966). The relationship of pH to the activity of inclusion bodies of *Heliothis* nuclear polyderosis **J.Invertebr. Pathol., 8:** 426-429

KRISHNASWAMY, S., NARASIMHANA, M.N., SURYANARAYANA, S.K. and KAMARAJ, S. (1978) **Manual on Sericulture. Silkworm rearing. Agric Seric. Bull., 15,** FAO, Rome.

NANGO, M. (1972). **HandBook of Silkworm Rearing.** Fuji publication, Tokyo, Japan.

PATIL, C.S. (1991). Studies on the evaluation of calcium hydroxide against cytoplasmic polyhedrosis virus of silkworm, ***Bombyx mori*** **L. Entomon 16:** 147-150

SAMSON, M.V. (1985). Silkworm rearing and diseases. **Indian Silk** (Oct-Dec.) pp. 26-30.

Seki, H. (1986). Effects of physico-chemical treatment on the silkworm, densonucleosis virus of the silkworm. *Bombyx mori* L. **Appl. Entomol. Zool., 21:** 515-516

VAIDYA, M.J. (1960). **Indian Sericulture Problems of Modernisation.** Popular brochure, CSB publication, Bombay, 64pp

YOSHIMITSU, I. and ZHOU, C.(1988). Inactivation by the treatment of nuclear polyhedrosis virus of silkworm, *Bombyx mori* L. with calcium hydroxide. **J.Seric. Sci., Jpn. 57:** 511-518.

(Received : March 95 Revised April 95)

Madras Agric. J., 83(2): 103-106 February 1996
https://doi.org/10.29321/MAJ.10.A00980

EFFECT OF IRRIGATION REGIMES, COMRADE CROPPING AND SOIL AMENDMENTS ON BIOCHEMICAL ANALYSIS, N, P AND K UPTAKE AND YIELD OF CASSAVA AND GROUNDNUT

M.AYYASWAMY AND C.CHINNUSAMY

Department of Agronomy
Agricultural College and Research Institute
Tamil Nadu Agricultural University
Coimbatore 641 003

ABSTRACT

Irrigation at 0.6 IW/CPE ratio recorded higher yield of tuber in cassava and pod and haulm in groundnut. Among the combinations, cassava raised as sole crop or as comrade cropping in groundnut recorded comparable yields. Coir waste applied @ 10 t. ha^{-1} increased the cassava tuber and groundnut pod yields. The quality of cassava tuber such as starch and total sugar contents increased and HCN content decreased as the moisture level increased. Nutrient up take was the highest under higher moisture regimes. Cassava raised as comrade cropping in groundnut registered maximum uptake of N, P and K. Application of coir waste @ 10 $t.ha^{-1}$ increased the quality characters and total uptake of nutrients by the plants.

KEY WORDS : Irrigation, Comrade Cropping, Cassava, Groundnut, Yield, Nutrient Uptake.

In India cassava is cultivated in an area of 3.08 lakh ha in Kerala and Tamil Nadu with an annual production of 56 million tonnes. It is cultivated in about 0.48 lakh ha in Tamil Nadu with a production of 1.5 million tonnes of tuber annually contributing about 42 per cent of the national production. Even with the higher contribution to the national cassava production, the productivity (10.25 tonnes ha^{-1}) is far below the normal productivity (19.33 tonnes ha^{-1} (FAO, 1988) as well as the maximum (40 tonnes ha^{-1}) potential productivity. Inadequate provision of inputs like water and nutrients are the probable reasons for the low productivity. Any attempt to develop a

package for efficient irrigation and moisture management may pave way for increasing the productivity of cassava. Cassava being a wide spaced crop with slow initial establishment and canopy coverage provides scope for raising short duration crops at early growth stages particularly under irrigated condition. With a view to accommodate the full population of cassava as well as intercrops, the concept of comrade cropping is being exploited. Bulky organic manures like farm yard manure and coir industrial wastes may play an important role not only in improving the physical and chemical condition of the soil but also in providing an ideal source of plant nutrient as well as for moisture conservation. In this context an attempt has been made to combine the effect of scheduling irrigation as well as comrade cropping in cassava production since little research has been carried out.

MATERIALS AND METHODS

The experiment was carried out during 1992-93 in Field No. R 1 of the Cotton Breeding Station. Tamil Nadu Agricultural University Coimbatore The soil of the experiment site was deep and clayey with moderately well drained condition. The soils were low in available N, medium in available P and high in available K Cassava variety CO 2 with a duration of nine months was selected for this study. Groundnut CO 1 maturing in 105 days was included in this study.

Treatment detail

Treatments on irrigation regimes were designed by taking into account the limited water resource situation. Three irrigation regimes based on irrigation water requirement and pan evaporation values were fixed with a view to study the effect of moisture stress and to optimize the irrigation requirement. Comrade cropping was included to study the possibility of including full population of both base and intercrops for additional benefit. Considerable importance was given to study the moisture conservation efficiency of organic amendments with suitable comrade cropping system in cassava with varied irrigation regimes.

Irrigation regimes in vertical strips

I_1 : 0.30 IW/CPE ratio with 5 cm depth of water

I_2 : 0.45 IW/CPE ratio with 5 cm depth of water

I_3 : 0.60 IW/CPE ratio with 5 cm depth of water

Organic amendments and cropping in horizontal strips

T_1 : Farm yard manure 12.5 $t.ha^{-1}$

T_2 : Coir waste 5 $t.ha^{-1}$

T_3 : Coir waste 10 $t.ha^{-1}$

S_1: Sole cassava

S_2 : Cassava + groundnut

Experiment was laid out in strip plot design with three replications, accommodating irrigation regimes in vertical strips and organic amendments and comrade cropping in horizontal strips. The gross plot was 4.8 m x 4.8m adopting the spacing according to the treatments chedule. The net plot was 4 m x 4 m after discarding borders in all the four sides of the plot. The cassava setts were planted on the top of the ridge with a spacing of 60 x 80 cm. The groundnut seeds were sown on both the sides of ridge with a plant spacing of 10 cm. Irrigation was given immediately after planting of cassava and sowing of groundnut and the life irrigation was given to all the plots on the third day after planting and sowing of comrade crops. Subsequent irrigations were given as per the treatment schedule. For scheduling irrigation based on climatological approach, evaporation rate from USWB Class A Open Pan evaporimeter at Agricultural Meteorological Observatory was recorded every day. The depth of irrigation was five cm. The amount of irrigation water let into each plot was maintained at six l sec^{-1} by using constant discharge irrigation module fixed at the experimental field.

The recommended package of practices were followed for cassava and groundnut for raising a healthy crop. For recording the following yield and biochemical analysis, tuber yield of cassava, pod yield of groundnut, starch content in cassava, HCN content in cassava, total sugar in cassava, oil content in groundnut crude protein in groundnut, N uptake and P and K uptake, five plants at random from net area of each plot were selected. The data were statistically analysed following the procedure described by Panse and Sukhatme (1985) for strip plot design.

RESULTS AND DISCUSSION

Effect of irrigation regimes

Irrigation management significantly influenced the tuber yield of cassava (Table 1). Irrigation given at IW/CPE ratio 0.45 (I_2) and 0.6 (I_3) produced higher tuber yield as compared to 0.3 (I1). Decrease in the synthesis of metabolities, reduction in translocation of nutrient from soil to plant and within plant, decrease in cell division and elongation could be considered as the main cause of depression in the grain yield of sorghum plants at longer irrigation intervals (E1-Bagoury *et al.*, 1984) This could be realised in the tuber yield of cassava irrigated at 0.3 (I_1) IW/CPE ratio. The increase in tuber yield under I_2 and I_3 over I_1 was 22.5 and 23.3 per cent, respectively. The pod yield of groundnut was significantly influenced by the irrigation regime of 0.6 as well as 0.45 IW/CPE ratio resulted in higher yield or groundnut. The per cent increase in yield of groundnut in I_2 and I_3 over I_1, were 24.2 and 26.2 per cent, respectively. This indicates the favourable effect of frequent irrigations on the yield of groundnut raised as comrade cropping. This is in close agreement with the finding of many investigators (Mohamed Ali *et al.*, 1974; Durai, 1982).

Irrigation given either at I_2 or I_3 increased the starch content and total sugar content in cassava tuber whereas the poisonous chemical HCN content in tuber and rind were reduced due to frequent and adequate irrigations with an interval of 12 to 16 days (Table 1). Increased starch as well as total sugar content and decreased HCN content c cassava associated with higher moisture regim might be attributed to adequate moistu availability and better crop growth. Favourable an adequate moisture availability with I_3 and resulted in higher oil content in groundnut (Tab 2). The total uptake of N, P and K by plants we significantly influenced by the irrigation leve (Table 2). N, P and K uptake were maximum at and less at I_2 and I_1. This might be due to bett availability of moisture which might have helped i better absorption of nutrients.

Effect of comrade cropping

Raising cassava as comrade cropping i groundnut significantly influenced the tuber yiel of cassava (Table 1). Raising groundnut a comrade cropping in cassava did not alter th groundnut pod yield compared to sole groundn (Table 1). This might be because of initial slo growth of cassava which could not have compete with groundnut for resources. Raising cassava a comrade cropping in groundnut did not change th quality of cassava tuber compared to sole cassav (Table 1,2). The oil and crude protein conten were not altered by comrade cropping (Table 2 since there was no competition for any resourc throughout the growth period of ground nut. Th cassava raised as comrade cropping in groundn (S_2) registered significant uptake of N, P and I compared to sole cassava (S_1) This might be due t the leguminous nature and complementary effect c groundnut crop which might have boosted th

Table 1. Effect of treatments on cassava tuber yield, groundnut pod and haulm yield, starch content in tuber and hydrogen cyanide content (HCN) of tuber and rind at harvest

Treatment	Cassava tuber yield ($t.ha^{-1}$)	Groundnut		Cassava		
		Pod yield ($kg.ha^{-1}$)	Haulm yield ($kg.ha^{-1}$)	Starch content (%)	HCN content ($\mu g\ g^{-1}$)	
					Tuber	Rind
I_1	31.6	1635	1993	31.0	26.73	214.11
I_2	40.8	2157	2557	34.3	23.05	194.75
I_3	41.2	2216	2697	35.2	22.59	192.72
CD	0.61	89.2	140.4	0.98	0.557	NS
S_1	38.0	-	-	33.5	24.00	200.33
S_2	37.7	-	-	33.5	24.24	200.72
CD	NS	-	-	NS	NS	NS
T_1	37.4	1954	2381	33.7	23.83	199.99
T_2	36.8	1920	2338	32 9	25.11	202.08
T_3	39.7	2135	2543	33.7	23.62	199.50
CD	0.62	40.3	49.9	0.79	NS	1.919

able 2. Effect of treatments on total sugar content (%) in tuber and oil and crude protein content (%) in groundnut and total uptake of N, P and K at harvest

Treatment	Total sugar content in cassava tuber	Groundnut		Total uptake by cassava and groundnut (kg.ha^{-1})		
		Oil content	Crude protein	N	P	K
I_1	1.92	46.32	21.60	312.62	44.46	363.51
I_2	2.49	47.30	21.41	435.62	63.30	491.82
I_3	2.51	47.34	20.60	449.70	68.30	506.46
CD	0.277	0.768	NS	4.441	1.971	9.073
S_1	2.31	-	-	353.97	53.62	444.17
S_2	2.30	-	-	444.65	63.74	463.02
CD	NS	-	-	8.752	3.323	12.681
T_1	2.35	49.96	21.36	389.33	55.43	449.00
T_2	2.15	46.93	21.40	386.71	53.61	441.36
T_3	2.41	47.07	20.84	421.90	67.20	483.50
CD	NS	NS	NS	10.72	4.070	15.531

ıptake of nutrients from the soil by favourable :ondition to cassava.

Effect of amendements

Incorporation of coir waste at 10 t.ha^{-1} (T_3) recorded significant tuber yield of 39.1 t.ha^{-1} compared to 37.6 t.ha^{-1} for FYM 12.5 t.ha^{-1} (T_1) and 36.8 t.ha^{-1} for coir waste 5 t.ha^{-1} (T_2) (Table 1). The percentage of increase of tuber yield in T_3 was 5.8 and 7.3 compared to T_1 and T_2. The positive effect of coir waste on yield might be possibly due to better soil physical conditions which promoted the infiltration rate in the soil with increased water holding capacity and better nutrient availability and uptake by the crop.

Though the addition of plant nutrients like N and P was in meagre quantities through coir waste application, the release of plant nutrients from soil pool into available form through mineralisation might be high due to the decomposition of coir waste in the soil which could have contributed significantly for higher tuber yield. Besides, 50 per cent additional dose of nutrients was applied to the coir waste incorporated plots to compensate the nutrients to be added through FYM and also to take care of the temporary immobilization of nutrients in the soil .

Coir waste applied at 10.t.ha^{-1} recorded significantly higher pod yield of 2133 kg.ha^{-1}t compared to 1954 kg with FYM 12.5 t.ha-1 (T_1) and 1920 kg in coir waste at 5 t.ha^{-1} (Table 1) The percentage increase in pod yield was 8.4 and 10.1 in T_3 over and T_1 respectively.

The quality characters like starch and HCN contents in tuber and rind and total sugars in tuber were influenced by the amendment application. The positive effect of coir waste at 10 t.ha^{-1} and FYM 12.5 t.ha^{-1} on quality characters might be possibly due to better soil physical conditions and increased water holding capacity which could have helped in better mineral absorption. Application of amendments significantly influenced the nutrient uptake by plants (Table 2). The increased uptake of N, P and K with coir waste at 10 t.ha^{-1} might be due to better and continuous moisture availability and other favourable physical conditions.

REFERENCES

DURAI, R. (1982) Studies on the effect of different soil amendments under varying irrigation regimes on groundnut (*Arachis hypogaea* L.) variety TMV 7. M.Sc., (Ag.) thesis, Tamil Nadu Agric. Univ., Coimbatore.

FAO, (1988) **Year Book , Production V 42:** 141-142

MOHAMED ALI, S., CHANDRAMOHAN, J. AND SHANTHA, R. (1974) Response of groundnut to different moisture regimes and farm yard manure. **Madras agric. J., 61:** 472-476

PANSE, V.G. and SUKHATME, P.V. (1985) **Statistical Methods for Agricultural Workers.** ICAR. New Delhi.

(Received : January 1995 Revised February 1995)