Influence of drip and fertigation on cassava production in Alfisols of Tiruchirappalli district of Tamil Nadu

V DHANUSHKODI and R NAGESWARI

Anbil Dharmalingam Agricultural College and Research Institute
Tiruchirappalli 620027 Tamil Nadu, India
Email for correspondence: dhanushselgi@yahoo.com.au

 Received: 14.10.2022/Accepted: 07.11.2022

ABSTRACT

Cassava is most important tuber crop grown frequently under rainfed conditions. But in sufficient water and lack of nutrient availability under rainfed farming in a critical growth period affects its growth and tuber yield. The main focus of the present study was to assess the effect of drip and fertigation on cassava (Kumkum Rose) under rainfed ecosystem in Tiruchirappalli district of Tamil Nadu. ICAR – Krishi Vigyan Kendra, Sirugamani, Tiruchirappalli district, Tamil Nadu introduced drip and fertigation in cassava production through demonstrations in 4.0 ha (10 demonstrations) under Tamil Nadu Irrigated Agriculture Modernanization Project funded by World Bank during 2019-22. The demonstrations were conducted during rabi season of 2019-20, 2020-21 and 2021-22. Trainings on cassava production technologies and water and nutrient management practices were imparted to selected farmers. Under this programme, drip irrigation system was installed and water soluble fertilizers were used in demonstrations in farmers' fields. The demonstrations were conducted with 3 treatments and 5 replications. Fertilizers were applied with three methods viz farmers' practice (own practice), soil test-based fertilizer recommendation and nutrient management through fertigation. Frequent field visits and inspections were done by the KVK scientists for monitoring the crop growth. Under the demonstrations, the farmers harvested a tuber yield of 26.9 tonnes/ha with average cost-benefit ratio of 1:3.2 from drip and fertigation adopted plots. It was noticed that more yield and income were influencing factors for higher profitability of cassava cultivation. Besides, adoption of drip and fertigation system exerted a beneficial effect on reduction in weed infestation, yield attributing characteristics and starch content of tuber.

Keywords: Cassava; drip; fertigation; weed intensity; yield; income

INTRODUCTION

Climate change is likely to impact agriculture and food security across the globe. A large fraction of the world's food is grown as rainfed annual crops in the tropics where climate variability plays an important role in determining productivity. Asia alone has more land under cultivation than all the industrialized nations taken together (Slingo et al 2005). Persistent low level of farmers' income under rainfed conditions can cause serious adverse effects on the future of agriculture in the country. In near future, several developing countries would face major challenge in achieving sustainable food security. For enhancing sustainable food production, proper and effective use of available land, water and fertilizer resources are essential. This requires agricultural intensification with the emerging concept of fertigation, scientific usage of micro-irrigation with water soluble fertilizers and prevention of soil pollution and restoration of soil health.

The yield and quality of the produce are mainly dependent upon the agronomic practices, mainly nutrient and water management. Under the present situation, cultural methods are needed to be modified and standardized based on the need of existing market and immediate attention has to be given for maximizing the productivity of crops. This is possible through application of adequate quantity of the available water and fertilizers economically as and when required (Maheswari 2018). Drip irrigation is one of the hi-tech methods which receives wider acceptance and

adoptability, particularly in areas of scarce water. Hence, it is very important that the concerted efforts be made to harness the available quantities of water for achieving higher productivity per drop of available water (Solaimalai et al 2005). Fertigation is a practice through which fertilizers are applied along with irrigation water through drip system. The crop yields are increased due to higher fertilizer use efficiency as the fertilizers are applied through drip system.

Cassava (*Manihot esculenta* Crantz) is the fourth supplier of dietary energy in the tropics (after rice, sugar and maize) and the ninth worldwide. It is a staple food in tropical countries and provides more than 10 per cent of the daily dietary caloric intake to about 300 million people in 15 African countries and in Paraguay (Anon 1999). It is one of the most important staple foods in the human diet in the tropics and ranks sixth most important source of calories in the human diet worldwide (Alves and Tim 2000). It is well known as a resistant crop especially to climate and soil conditions. It can grow in places where cereals and other crops do not grow well and can be cultivated in areas receiving less than 300 mm rainfall per year with a dry season of four to six months (Odubanjo et al 2011). With a better planting material (stem) and improved input management, the productivity of cassava could be doubled (Kehinde et al 2011). Therefore, the objective of this study was to assess the effect of drip and fertigation on growth and yield of cassava in Alfisols of Murungai village in Tiruchirappalli district, Taml Nadu.

MATERIAL and METHODS

ICAR – Krishi Vigyan Kendra, Sirugamani, Tiruchirappalli district, Tamil Nadu introduced nutrient management through fertigation along with drip in cassava (Kumkum Rose) as pure crop through demonstrations in 4.0 ha (5 locations). The demonstrations were conducted during rabi season of 2019-20, 2020-21 and 2021-22. All inter-cultural operations were followed as per the recommendations of Tamil Nadu Agricultural University. The experiment consisted of three treatments viz farmers' practice (FP), recommended fertilizer applied in soil (SA) and fertigation with five replicates conducted in farmers' fields. Each plot size was 5 m × 4 m separated by 0.9 m wide spacing for demarcation between plots making fifteen plots and four to five nodes were planted vertically per plot at a spacing of 0.9 m × 0.6 m. The crop was maintained at near field capacity for the first month to enhance good crop establishment. A fertilizer application through drip was adopted for the experiment (Table 1). Drip laterals were laid out at 0.9 m spacing between the rows. The drippers were placed at 0.9 m apart along the lateral line with a discharge capacity of 6 lph each. The yield and income of farmer's practice and different treatments were collected for interpretation. The calculation of benefit-cost ratio was done by finding the ratio between the gross return and total cost of production. The data on growth parameters and yield attributes were pooled and analyzed statistically as per Gomez and Gomez (1984).

RESULTS and DISCUSSION

Outlook on superiority of drip and fertigation over conventional method

The performance of different irrigation methods and fertilizer application in cassava production is presented in Table 2. The data reveal that the performance of drip and fertigation system was found to be considerably different. Among the three methods of nutrient applicationon, drip and fertigation proved their superiority than other treatments. Better performance in growth characters viz stem height (1.81 m/plant) and yield parameters viz number of tubers (5.3/plant), tuber yield (6.4 kg/plant) and stem yield (4.1 kg/plant) was observed in fertilizer applied through drip. The highest cassava tuber yield of 26.9 tonnes/ha was recorded with application of water soluble fertilizer through drip. However, the lowest tuber yield (23.4 tonnes/ha) was recorded in control (farmers' practice). This difference in yield might be due to the fact that availability of nutrients through fertilizers, water regime and environmental conditions was reflected in growth and yield of tuber (Odubanjo et al 2011, Li et al 2021).

Economic difference of cassava by drip and fertigation under rainfed situation

The total income accrued to the farmers from the cassava cultivation under drip irrigation is presented in Table 2. It consisted of the monetary value of all products and byproducts like stem. It was found that more net income (Rs 1,79,200/ha) and benefit-cost ratio of 3.2 was recorded by the application of water soluble fertilizer through drip (Fig 1). The demonstration in cassava resulted in 15.0 per cent additional yield and thus proved highly profitable. Similar results of application of fertilizers in drip helps in saving irrigation water and also fertilizers requirement were recorded by Jain et al (2021) in summer peanut.

Table 1. Fertilizer applied through drip

Crop stage	Days interval	Name of fertilizer grade used (nutrient content in %)									Quantity applied (kg/ha)		
		1st dose			2nd dose			3rd dose			1st dose	2nd dose	3rd dose
		N	P	K	N	P	K	N	P	K			
Planting to crop establishment	20	19	19	19	13	0	45	0	0	50	23.57	34.67	7.87
Vegetative stage	30	12	61	0	13	0	45	Urea	0	0	11.40	105.33	26.80
Tuber formation stage	35	12	61	0	0	0	50	Urea	0	0	11.40	144.00	55.73
Tuber development stage	35	19	19	19	0	0	50	Urea	0	0	23.57	182.67	48.87

Table 2. Effect of drip and fertigation on yield and income of cassava (mean of five locations)

Technologies implemented	Plant height (m)	Number of tubers/plant	Tuber yield (kg/plant)	Stem yield (kg/plant)	Tuber yield (tonnes/ha)	Additional yield (%)	Net return (Rs/ha)
Farmers' practice (own practice)	1.62	4.5	4.1	3.1	23.4	-	1,32,200
Recommended fertilizers on soil	1.75	5.2	5.5	3.4	25.2	7.7	1,55,600
Recommended fertilizers through fertigation	1.81	5.3	6.4	4.1	26.9	15.0	1,79,200

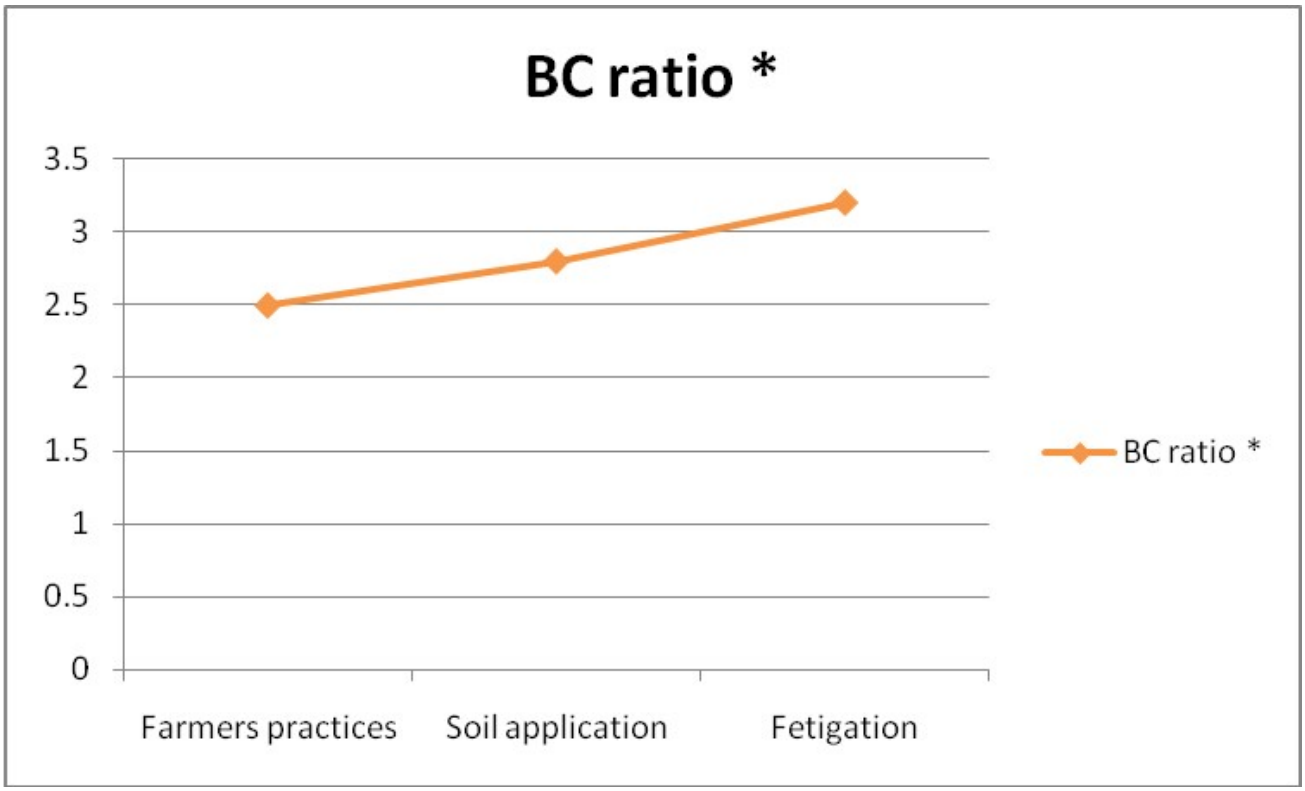

Fig 1. Effect of drip and fertigation on B-C ratio in cassava production

Effect of drip and fertigation on quality and weed intensity in cassava

The quality parameters of cassava were positively influenced by different nutrient management practices and drip irrigation system. The more starch content of 30.1 per cent in cassava tuber was recorded by the fertilizers applied through water soluble fertilizers under rainfed situation and drip irrigation system (Fig 2). This might be due to the favourable effect of nutrient availability by the water soluble fertilizers in the root zone. The water soluble fertilizers applied through drip favourably increased the nutrient availability so that nutrients that were contained in them were available for the crop and increased the yield and quality of cassava. Under drip irrigation, it was found minimum weed infestation (16.9%) (Fig 3). It might be due to the reason that wetting of soil near root zone by drip, weed infestation was very less in comparison to the conventional irrigation (Okasha et al 2020.).

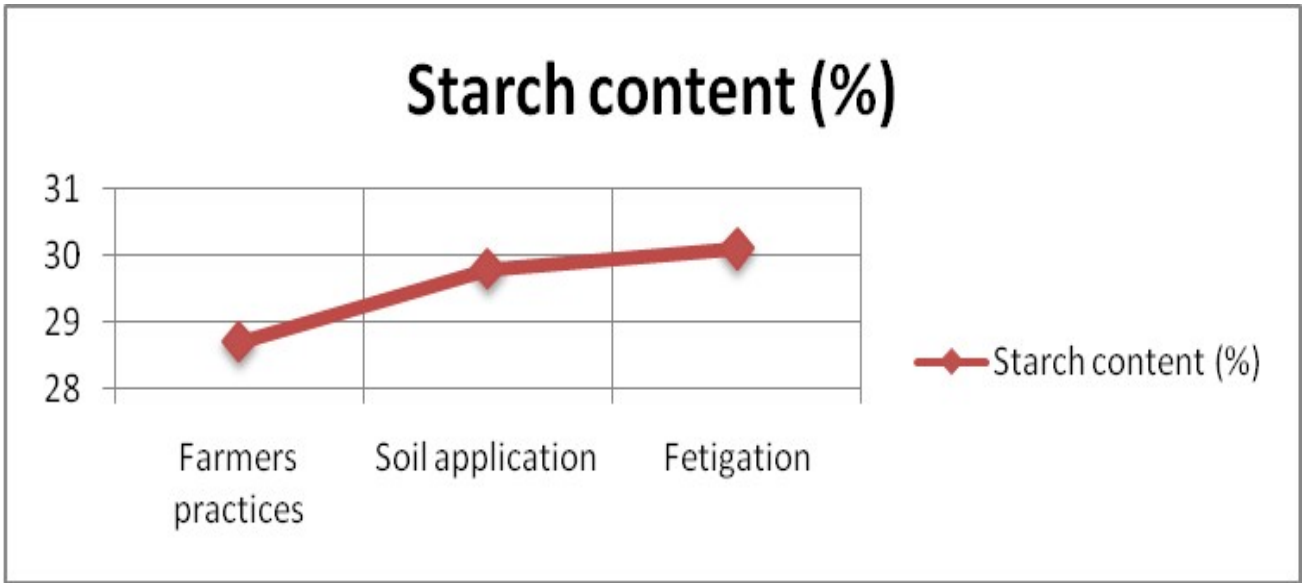

Fig 2. Effect of drip and fertigation on starch content in cassava tuber

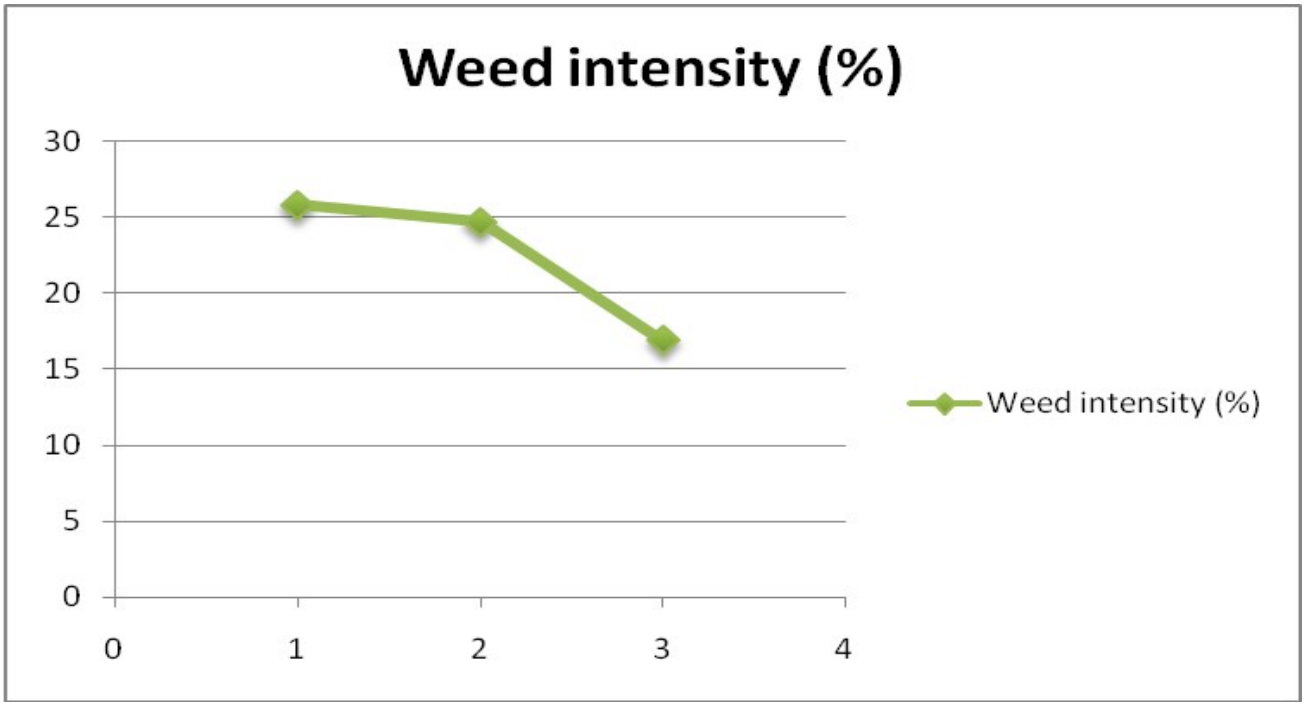

Fig 3. Effect of drip and fertigation on weed intensity in cassava production

CONCLUSION

The results of these investigations brought out that remarkably higher yield and income of cassava with better quality could be achieved through application of fertilizers through drip. Favorable benefit-cost ratio is self-explanatory of economic viability of the drip and fertigation which is highly suitable for enhancing the productivity of cassava in Tiruchirappalli district in Tamil Nadu. The farmers harvested a cassava tuber yield of 26.9 tonnes/ha from drip and fertigation adopted plots and average benefit-cost ratio of 1:3.2 due to demonstrations. It was noticed that more yield and income were influencing factors for higher profitability of cassava cultivation. It is concluded that adoption of drip and fertigation system exerted a beneficial effect on reduction in weed infestation and enchancing yield attributing characteristics and starch content of tuber.

REFRENCES

Alves AAC and Tim LS 2000. Response of cassava to water deficit: leaf area growth and abscisic acid. Crop Science **40(1):** 133-137.

Anonymous 1999. Cassava: post-harvest operations. INPhO Post-harvest Compendium, Food and Agriculture Organization of the United Nations, Rome, Italy.

Gomez KA and Gomez AA 1984. Statistical procedures for agriculture research. 2nd edn, John Wiley and Sons, New York, USA, 680p.

Jain NK, Yadav RS and Jat RA 2021. Productivity, profitability, enzyme activities and nutrient balance in summer peanut (*Arachis hypogaea* L) as influenced by NPK drip fertigation. Communications in Soil Science and Plant Analysis **52(5):** 443-455.

Kehinde OM, Yahaya O, Oloruntade AJ and Afuye GG 2011. Effect of supplemental irrigation on growth, development and yield of cassava under drip irrigation system in Akure, Ondo state, Nigeria. Journal of Science and Multidisciplinary Research **3:** 62-73.

Li H, Mei X, Wang J, Huang F, Hao W and Baoguo L 2021. Drip fertigation significantly increased crop yield, water productivity and nitrogen use efficiency with respect to traditional irrigation and fertilization practices: a meta-analysis in China. Agricultural Water Management **244:** 106534; doi: 10.1016/j.agwat.2020.106534.

Maheswari MU 2018. Drip fertigation in pulses: a novel approach to boon the yield. Biomedical. Journal of Scientific and Technical Research **11(3):** 8573-8581.

Odubanjo OO, Olufayo AA and Oguntunde PG 2011. Water use, growth and yield of drip irrigated cassava in a humid tropical environment. Soil and Water Research **6(1):** 10-20.

Okasha EM, El-Metwally IM and Tarabye HHH 2020. Effect of irrigation systems and weed control on the water application efficiency, weed growth, yield, water productivity and quality of soybean crop under clay soil conditions. Plant Archives **20(1):** 3102-3111.

Slingo JM, Challinor AJ, Hoskins BJ and Wheeler TR 2005. Introduction: food crops in a changing climate. Philosophical Transactions of the Royal Society B: Biological Sciences **360(1463):** 1983-1989.

Solaimalai A, M Baskar M, Sadasakthf A and Subburamu K 2005. Fertigation in high value crops- a review. Agricultural Reviews **26(1):** 1-13.