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Feasibility Study of Marigold as Intercrop in Drumstick Cultivation for Interim Income Generation

G Venu Gopal [a++*], N Venkateshwar Rao [a#], L Mahesh [a†], D Srinivas Reddy [a‡] and J Vijay [a^]

[a] Krishi Vigyan kendra, Jammikunta, Karimnagar (Dist) Telangana State-505122, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Drumstick (*Moringa oliefera* Lam.) PKM-1(Annual) is an important perennial vegetable crop present cultivating in India not only as vegetable and for moringa leaf powder. India is the main producer of drumstick in the world because higher contribution is due to favourable temperature during flowering and fruit development stages. Even though encountered several production hurdles resulting greater yield loss due to existing climatic conditions during fruit developmental stages. But this crop gave them perfect assurance in giving good income in an average about 2-3 Lakhs rupees

[++] SMS (Horticulture);
[#] Senior Scientist and Head;
[†] SMS (Agril.Extension);
[‡] SMS (Plant Protection);
[^] SMS(Agronomy);
**Corresponding author: Email: venulyrics2@gmail.com;*

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over a period of 2 years. Based on weather conditions farmers were being come forwarded by training programmes conducted by our KVK from 2017-till date, we have documented the farmers results by growing intercrops mainly marigold crop. Which gives good yield and good income to the farmers before pod formation of drumstick. Marigold is 110 days crop where drumstick gives first yield after 7 months. In between marigold crop not only giving accountable benefits to the farmers and it reduces the nematode problems in the field as well explained by Steiner, 1941 Marigold (*Tagetes erecta*) is one of the most widely studied plant genera due to its allelopathic potential against PPNs. Marigolds' repressive impact on nematodes has been documented for over 50 years and some studies said that spiral (*Helicotylenchus multicinctus*) nematodes are responsible for yield losses of 30–60% in many banana-producing countries in the tropics (Davide, 1995, Speijer and Kajumba, 1996, Kashaija et al., 2004) . The partner crops of the intercropping system share space, water, and nutrients making the most efficient utilization of available resources (Xu et al., 2020). Earlier farmers were paddy growers where they didn't see profits by selling paddy in IKP centers or as individual sales. So We conducted trails in Huzurabad Division and Errabelli villages of Karimnagar District (Old Karimnagar District), got successful results by doubling the farmer's income. Raised marigold seedlings in KVK during June month and supplied to the farmers. Transplanted marigold and Drumstick in July month with 60cm x60cm and Drumstick spacing was 3mx3m where 444 plants were accommodated in one acre area, Intercropping is an agricultural system that improves land use efficiency through simultaneous cultivation of more different crops in the same field using functional complementarity to increase resources utilization, increase the productivity of crops and nutrient-use efficiency (Chifflot et al., 2006; Zhan and Li, 2003) Even went through many hurdles in marigold and drumstick crops in rainy season due to paddy growing soils and water logging conditions. In this, observed positive effects on soil carbon and nitrogen of intercropping found in previous intercropping studies (Makumba et al., 2007), [1]. Results are as follows we harvested 36.80Q per acre in 8 pickings and after drumstick pods harvested from February up to June 134 pods per tree. It shows C: B ratio as drumstick (PKM1) contribution 1:11.7 and marigold (Tanindo (Yellow and Orange) contribution 1:4.3 to the farmers. The demonstration plots reported that yield of marigold and drumsticks are 38.6Q and 49.58Q per acre. Farmers got good income Rs. 2, 74,160.00 through two crops in one acre area with Marigold as inter crop in Drumstick plantation. Based on this success story of the farmers, NABARD bank started giving loans to the farmers and they published this success story in their credit linkage plan 2018-19.

Keywords: Intercrop marigold; PKM 1-drumstick cultivation.

1. INTRODUCTION

Drumstick *(Moringa oleifera* Lam.) is the most important commercially grown perennial vegetable crop of the country. India has the richest collection of Drumstick cultivars. India ranks first among world's Drumstick producing countries accounting for about 50% of the world's Drumstick production. It is very popular for leaves, seeds, seed pods, flowers and roots are very nutritious, rich in vitamins A and C, iron and calcium, which help to (a) keep the skin healthy and smooth, (b) to make people strong and resistant to cold and infections and (c) to keep our bones strong. The drumstick tree is also grown as a homestead crop. Drumstick leaves contain 7 times the vitamin 'C in oranges, 4 times the calcium in milk, 4 times the vitamin 'A' in carrots, 3 times the potassium in banana and 2 times the protein in milk. The plant can be considered as a powerhouse of nutritional value. The benefits of the drumstick studied by Diksha Manaware 2020, that drumstick is highly valued for its indispensable medicinal properties and nutritional benefits. Moringa oleifera has enormous potential uses. The shade of the drumstick plant does not hinder the growth of other crops. It is a perennial, fast growing, drought resistant tree, which can reach up to 12 m in height at maturity. Drumstick is also suitable to grow as a mixed crop with a wide range of perennial crops. Besides, its nutritional and medicinal applications, drumstick is very useful as an alley crop in the agro-forestry industry [2] to reduce soil erosion and improve soil conservation. Based on its importance we have conducted trainings to double the farmers income by crop diversification from paddy growers. Marigold is one of the most popular, annual, free flowering, and short-duration flowering crops. These flowers are known for their vibrant orange and yellow blooms, which

add a cheerful touch to gardens and landscapes. Marigolds are native to Mexico and Central America but are now grown worldwide. In India, major marigold-growing states are Tamil Nadu, Karnataka, Telangana, Andhra Pradesh, Karnataka, Madhya Pradesh and Maharashtra. They are widely grown for their use in various religious and cultural ceremonies. In addition to their ornamental value, marigolds are also known for their medicinal and culinary uses. Commonly cultivated marigold species are African marigold (Tall) and French marigold (Dwarf). Marigold cultivation is an important source of income for many farmers in India. We decided to motivate the farmers for cultivating profitable crops like Drumstick and marigold in one acre can change the mindset and income values.

2. MATERIALS AND METHODS

The present study was carried out by the Krishi Vigyan Kendra during *Kharif* and *Rabi* seasons from 2017 to 2019 at the farmer's fields of different divisions of the Karimnagar district, Telangana. Selected 6 farmers in Huzurabad and Bheemadevarapalli divisions of old Karimnagar District and Profile of the district has shallow black soils (18.4%), deep calcareous soils (16.6%) and red clayey soils (15.2% of area). However, as a whole, red soils of different textures are predominant in this zone to an extent of 45 per cent and is followed by black soils (24%) and calcareous soils (20%). Annual actual rain fall was recorded 798.9 mm, Normal rainfall was recorded as 1195.5mm in 2017-2018.Conducted training programmes to the famers. Firstly we conducted group discussions to the women farmers and followed by training programmes in the villages.

The seeds of drumstick PKM1-PHS Samurai and Tanindo Yellow and Tanindo orange seeds purchased from private companies but nursery raised in our KVK Jammikunta, the seedlings and saplings were transplanted, marigold during the 1st week of June and Drumstick planted in July 2018 and continued for two years. Drum stick plants planted with 3mx3m (444 plants/ Ac) spacing where marigold transplanted with 60cmx60cm (11111plants /0.4Ha) as intercrop accommodated in three rows between drumstick plants. High density planting with combination of planting systems has been successfully demonstrated in mango [3]. Fertilizer sources for N,P,and K elements constituted urea (46% N), single superphosphate (18% P2 O5), and muriate of potash (50% K2 O), respectively given in the period as Recommended Dose of Fertilizer (RDF) is 90: 90:75kg NPK/ha [4]. We applied 8Kg: 8Kg: 10Kg NPK/Acre throughout the crop period of drumstick. On the other hand, excessive nitrogen fertilization may result in lush growth and subsequently increased insect damage and disease problems (Agrios 1997). Irrigation was crucial in both crops Drumstick and Marigold because in heavy water drumstick crop not withstanding and where marigold crop getting bud rot diseases so given irrigation as per moisture percentage in the soils. Subsequent irrigations were applied when needed depending upon climatic conditions, rate of precipitation, and rate of usage. All other cultural practices, e.g., weeding, hoeing, staking, and IPM, were kept similar for all treatments during the entire period of the study. Data were collected at flowering stage, number of flowers plant, flower diameter (cm), fresh and dry weight of a flower (g), and flower quality (Cooper and Spokas 1991). Checked and observed while field data collection of leaves for nutrient deficiencies and collected some samples. Because to determine leaf nitrogen [5]. Without healthy plant can't get good yield in drumstick [6-8].

3. RESULTS AND DISCUSSION

Data on both marigold and drumstick cultivation was collected from vegetative stage to fruiting stage in crop periods in all the locations. There is no significant difference among drumstick and marigold crops with respect to growth and yield up to harvesting stages. The main crop Drumstick enhances nitogren fertilizer levels in the field and that Nitrogen fertilization has generally significant influence on many biochemical quality parameters of plants, said by Mohammad and Kazem Souri et al. [9].

Table 1. Demonstration results given below

Treatments	Yield (Q/Ac)	Cost of cultivation (Rs/Ac)	Gross income (Rs/Ac)	Net income (Rs/Ac)	B:C ratio
Marigold (Private hybrid)	36.8	34120.00	147200.00	113080.00	1:4.3
Drumstick PKM1	49.58	15000.00	176880.00	161080.00	1:11.7

Table 2. Drumstick (PKM-1) cultivation data on parameters

S. No	Particulars	Rs.
1	Cost of the plants (440 plants per Ac)	6600.00
2	Labour charges (including Land preparations) (Rs/Ac)	3100.00
3	Fertilizers and chemicals (Rs/Ac) (Neem powder, fungicides and Spraying chemicals)	5300.00
4	Cost of cultivation (Rs/Ac)	15000.00
5	Gross returns (Rs/Ac) (Avg price per each drum stick Rs.3.00) X (avg no. of drumsticks per plant 134) (134 x 440 x 3.00) (Yield-49.58Q)	176880.00
6	Net returns (Rs/Ac)	161080.00
7	**C:B ratio**	**1:11.7**

Table 3. Hybrid marigold cultivation: Data on parameters

S. No	Particulars	Tanindo Yellow private hybrid
1	Seed cost (Rs/Ac)	21200.00
2	Land preparation (Rs/Ac)	3200.00
3	Fertilizers and pesticides (Rs/Ac)	8120.00
4	Weeding labour charges (Rs/Ac)	1600.00
5	Cost of cultivation (Rs/Ac)	34120.00
6	Yield (Q/ Ac)	36.80
7	Wholesale market price per Kg flower	40.00
8	Gross returns (Rs/Ac)	147200
9	Net returns (Rs/ Ac)	113080.00
10	C:B Ratio	1:4.3

The provided data (Table 2 and Table 3) of the trails conducted by KVK in Huzurabad division and Bheemadevarapalli mandals, this experiment conducted in 2017–18. The key parameters evaluated include yield (Q/Ac), cost of cultivation (Q/Ac), and gross returns (Q/Ac), net returns (Q/Ac), and the benefit-cost (B: C) ratio. This analysis aims to determine the effectiveness of the demonstration plots in improving productivity and economic returns compared to traditional practices represented by the check plots [10,11]]. The demonstration plots reported that yield of marigold by 7 pickings and drumsticks by harvesting 13 times are 38.6Q and 49.58Q per acre. In 110 days of marigold crop after 8 pickings got net returns for the marigold Rs. 113080.00 ha-1 significantly higher than the mono crop farmers and on par for their one acre marigold crop ha-1 for the check plots., the gross returns were Rs. 147200.00 ha-1 for the marigold plots (Table 3) and. Gross cost of cultivation is about 34120.00 (Table 2) [12].

These figures highlight the superior economic performance of the demonstration plots. The Benefit-Cost (B: C) ratio is a critical indicator of economic efficiency, reflecting the return on investment for every unit of currency spent. The benefit-cost (B: C) ratio is a critical indicator of economic efficiency, reflecting the return on investment for every unit of currency spent [13].

The B: C ratio for the marigold cultivation is 4.3: 1 significantly better than empty land as mono cropping that to solo Drumstick plantation. For the demonstration of Drumstick plantation B: C ratio is 11.7:1 during 2017–18. The total income from one acre is Rs.2, 74,160.00 as intercropping in drumstick cultivation where gross cultivation cost is Rs.49, 120.00 and gross income is Rs. 3, 24,080.00. It is showing that demonstration on intercropping in combination of perennial vegetable and marigold gave good income to the farmers than monocropping cultivation practices. The study significantly showed that intercrop with marigold not only gave yield but also yields money to the farmer. Based on this data NABARD, Karimnagar took intiation to give crop loan and subsidy programme for drumstick growers about Rs.50000.00 per acre and repayment on or before of 2years of plantation. Some farmers were benefitted with this scheme [14,15].

4. CONCLUSION

Farmers used to cultivate paddy and cotton crops but they gained lesser yields and less income. They felt unhappy with higher investments and less profits. Then they came to know higher income with less cost of cultivation by drumstick plantation and marigold as intercrop with technical support of KVK they were inspired to do this trials. From Marigold they got 36.8Q/ Ac as intercrop and the average market price was Rs.40 per Kg flowers. The cost of cultivation was 34120/- for marigold and the net income 113080/- and from drum stick, they got 134 pods/tree from 444 plants per acre with the spacing of 3mx3m and the yield was 49.58q/acre, farmers got good income Rs. 2, 74,160.00 from two crops in one acre area with Marigold as inter crop in Drumstick plantation. It is interim income for the farmers.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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