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Doubling the Farmers Income by Adopting the Suitable Tomato-Cucurbit Polyculture on the Raised Bed with Drip System in the Tribal Dominating Areas under Dhar district of Madhya Pradesh, India

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A B S T R A C T

An assessment trial was conducted at farmer's field of adopted village Awalia of RVSKVV, Krishi Vigyan Kendra Dhar, M. P. during the rabi season, 2016-17. Among the various cucurbits polyculture with tomato on raised bed, the higher return obtained from the polyculture with ridge gourd and tomato on raised bed cultivation. It is concluded that polyculture are not contradicted by the observation that one monoculture can be the most profitable method per ha. As long as there is a sufficient market demand for the other crop to be grown at all, it may best be grown in polyculture, rather than by taking land away entirely from production of the more valuable crop. Monoculture leads the higher production with high cost of cultivation and increasing the incidence of insect, pest and diseases. While, polyculture is the best way to reduce the constraints and it effective for the farmers to doubling the income and ensure the production even in adverse climatic condition

Introduction

Growing of Tomato and cucurbits on the raised beds with drip irrigation system are more appropriate for growing high value crops that are more sensitive towards water logging or stress. This system is advantageous in areas where ground water levels are falling and herbicides resistant weeds are becoming a problem. Raised bed alters the crop geometry and land configuration offers more effective control over irrigation and drainage as well as their impact on transport and transformation of nutrients and rain water management. Farmers, generally practiced to grow monoculture crop of tomato and different cucurbits on raised bed separately with the major support of drip system but the growing of polyculture on raised bed is not only effective for space utilization but also produces synergistic effect with high benefit cost ratio. Monoculture leads the higher production with high cost of cultivation and increasing the incidence of insect, pest and diseases. While, polyculture is the best way to reduce the constraints and it effective for the

farmers to doubling the income and ensure the production even in adverse climatic condition. Our study is a first attempt at elucidating the biological and economic aspects of growing these two commercial vegetables in the dry area of tribal belt of Dhar district of Madhya Pradesh.

Materials and Methods

An assessment trial was conducted at farmers' field of adopted village Awalia of RVSKVV, Krishi Vigyan Kendra Dhar, M. P. during rabi season, 2016-17. The soil of experiment site was medium black with less moisture. The experimental materials for the present investigation were laid out in randomized block design and replicated five times. Raised bed and furrows were made bed raiser tractor drawn machine keeping the accuracy. According to the treatments 60 cm (centre to centre of furrows) width bed was made. For the 60 cm bed, the top of the raised bed was 35 cm, and furrow between beds was 25 cm. The beds were made one day before transplanting, the plots according to layout of the experiment. The heights of beds were 15 cm. Tomato seedlings of hybrid were transplanted on 30cm spacing on raised bed in the moth of 15th November. After one moth of transplanting of tomato the seeds of cucurbits viz., sponge gourd, ridge gourd and bitter gourd were sown at 60 cm, while bottle gourd at 120cm as polyculture in tomato. Densities were as recommended for maximum yields of monocultures. The polyculture consisted of both crops in the same rows and at their monocultural densities. Liquid fertilizer was applied through fertigation system as per the recommendation. All the observations related to growth and yield attributing traits of tomato and cucurbits were recorded as per standard procedures from five randomly selected plants of each treatment in all the replications and their mean were worked out for statistical analysis (Panse and Sukhatme, 1989).

Results and Discussion

The mean performance of the monoculture and the polyculture of tomato with different cucurbits in Table 1 revealed significant result on growth and yield parameters. Treatment T1 clearly indicated that the Tomato grown as monoculture crop in the raised bed with drip system produced plant height (1.5m), No. of leaves per plant (122.44), No. of branches/ plant (20.08), Fruit length 10.09 cm, Fruit yield /plant (25.66kg) and 512.66 q/ha. The benefit cost ratio is 4.42 (Table 2). Treatment T-2 clearly indicated that the Bottle gourd grown as monoculture crop in the raised bed with drip system produced vine length (5.50m), No. of leaves per plant (48.66), No. of branches/ plant (21.10), Fruit length (40.40 cm), Fruit yield /plant (6.20) and 208.40q/ha. While, the same parameters 5.30, 45.5, 18.41, 45.16, 5.89, 194.50 for plant height, No. of leaves per vine, No. of branches per vine, fruit length, fruit yield in Kg and Q/ha, respectively were recorded with polyculture. The benefit cost ratio is 2.08 in the monoculture crop and 4.3 when polyculture with tomato (Table 2). Treatment T-3 and T-7 clearly indicated that the sponge gourd grown as monoculture crop in the raised bed with drip system and polyculture with tomato produced vine length (2.90, 2.50m), No. of leaves per plant (56.41, 52.41), No. of branches/ plant (24.06, 22.06), Fruit length (22.81, 25.17cm), Fruit yield/plant (2.90, 2.52) and 171.20 and 151.20q/ha., respectively (Table 1). Treatment T-5 and T-9 clearly indicated that the bitter gourd grown as monoculture crop in the raised bed with drip system and polyculture with tomato produced vine length (3.80and 2.90met.), No. of leaves per plant (114.09and 103.04), No. of branches/ plant (29.11and 28.79), Fruit length (11.50 and 12.74cm), Fruit yield /plant (1.60 and 1.26 kg) and 150.40and 125.80q/ha., respectively (Table 1). The benefit cost ratio is 3.06and 4.80 respectively (Table 2).

Table.1 Growth and yield attributing parameter under polyculture and monoculture of tomato and cucurbit crops

Treatments	Plant/ vine length (m)	No. of leaves/ plant	No. of branches/ plant	Fruit length (cm)	Fruit yield /plant (kg)	Fruit yield (Q/ha)
T1- Tomato monoculture on raised bed with drip system	1.50	122.44	20.08	10.09	25.66	512.66
T2-Bottle gourd monoculture on raised bed with drip system	5.50	48.66	21.10	40.41	6.20	208.40
T3-Sponge gourd monoculture on raised bed with drip system	2.90	56.41	24.06	22.81	2.90	171.20
T4- Ridge gourd monoculture on raised bed with drip system	4.00	55.65	22.09	28.76	3.00	164.20
T5-Bitter gourd monoculture on raised bed with drip system	3.80	114.09	29.11	11.50	1.60	150.40
T6-Bottlegourd tomato polyculture on raised bed with drip system	5.30	45.5	18.41	45.16	5.89	194.50
T7- Sponge gourd tomato polyculture on raised bed with drip system	2.50	52.41	22.06	25.17	2.52	151.20
T8-Ridge gourd tomato polyculture on raised bed with drip system	3.50	49.55	19.50	30.33	2.49	149.50
T9-Bittergourd tomato polyculture on raised bed with drip system	**2.90**	**103.04**	**28.79**	12.74	1.26	125.80
SEm±	0.84	1.24	2.02	1.85	0.25	1.67
C.D. at 5%	2.22	3.31	5.39	4.93	0.66	4.45

Table.2 Economics of different treatments

Treatments	T1	T2	T3	T4	T5	T6	T7	T8	T9
Yield q/ha	512.66	208.40	171.20	164.20	150.40	194.50	151.20	149.50	125.80
Gross Return	486400	166720	256800	328400	255714	642000	713200	785400	700260
Cost	110100	80000	82000	82000	83500	150100	148100	147300	146900
Net Return	376300	86720	174800	246400	172214	425400	496400	568300	483160
B:C Ratio	4.42	2.08	3.13	4.00	3.06	4.3	4.8	5.3	4.8

The benefit cost ratio in the sole crop is 3.3 and 4.8 when polyculture with tomato (Table 2). Treatment T-4 and T-8 clearly indicated that the ridge gourd grown as monoculture in the raised bed with drip system and polyculture with tomato produced vine length (4.00and 3.50met.), No. of leaves per plant (55.65and 49.55), No. of branches/ plant (22.09and 19.50), Fruit length (28.76 and 30.33cm), Fruit yield/plant (3.00 and 2.49 kg) and 164.20 and 149.50q/ha., respectively (Table 1). The benefit cost ratio in the monoculture crop is 4.00 and 5.30 when polyculture with tomato (Table 2).

Cultivation of tomato with ridge gourd on raised bed with drip system provided the better opportunity to grow each crop with synergistic effect on growth and yield. The highest remuneration result the higher income with low cost. The higher return in polyculture might be due to proper space and nutrient utilization coupled with onetime or combine land preparation, land configuration, installing drip, plant staking structure etc. reduced the cost of cultivation, while cultivation of cost was higher in monoculture, thus reduced the net return. In poly culture tomato in combination with ridge gourd gave highest net return and benefit cost ratio might be due to its low nutrient requirement and less affected by insect –pest, fetched higher market price and initial good crop condition when tomato protects the seedlings of ridge gourd to low temperature and later on ridge gourd protected the tomato from not only scorching sunlight but also extend the period of fruiting span of tomato, resulting the synergistic effect on both the crop. Ridge gourd fetched early market and tomato fetched late market, thus the higher returns were associated with this polyculture. Similar result were found by Schultz *et al.,* 1982 who suggested that the polycultures can provide a greater dollar value per ha than mono-culture. Diversification using mono- cultures of tomatoes and cucumbers has already been suggested by Schurle and Erven, 1979.

In summary, the data presented here strongly suggested that the polyculture of tomatoes and cucurbit-ridge gourd might prove advantageous as providing higher return and benefit cost ratio from per unit area in the raised bed cultivation with fertigation system. Monoculture leads the higher production with high cost of cultivation and increasing the incidence of insect, pest and diseases. While, polyculture is the best way to reduce the constraints and it effective for the farmers to doubling the income and ensure the production even in adverse climatic condition

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