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Synergistic efficacy of organic vegetables under tunnels and field conditions

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Abstract: A field experiment was conducted at research fields of National Institute of Organic Agriculture (NIOA), NARC, Islamabad, Pakistan during Kharif 2011-2012. Summer season vegetables i.e. long gourd, bitter gourd, sponge gourd and farashbeans were grown under walk-in tunnels and open field. Vegetable seedling grown in the first week of July in polythene tubes were shifted during the first of August in open fields. Enriched compost @ 100 kg of per acre was used in furrows in the plots in two split doses. The results revealed that long gourd, bitter gourd, sponge gourd and farash beans yielded 77.0, 13.6, 18.4 and 39.4 kg/plot respectively as compared to the vegetables in open field with the production 54.5, 5.85, 4.55 and 34.9 kg/plot.

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INTRODUCTION

Pakistan's diverse conditions provide an opportunity of growing vegetables and condiments including species in all seasons around the year in all provinces. There has been a gradual increase in both area and production of vegetable crops for the past three decades. Out of total 20.43 M hectare of arable land of Pakistan, the area under vegetable cultivation was 0.41 M hectare while during 2009-10, the area of vegetable was 0.38 M hectare[1]. Therefore, a large variety of summer and winter vegetables are grown in Pakistan throughout the year.

Vegetables are low in fat but contain good quantity of minerals and vitamins. The vegetables help body protect from oxidant stress, disease and cancers and secondly the vegetables help in developing capacity to fight against these diseases by boosting immunity. They also contain soluble and insoluble dietary fiber like gums, cellulose, pectin etc. that absorb excess water in the colon and help the easy passage of fecal matter out of body[2]. Nature of various food materials ad their effects on the body such as long gourd, bitter gourd, sponge gourd, beans, egg plants, cucumbers is useful to facilitate the human body. The natural food not only supplements the food shortage but also contributes the necessary nutrients to the body[3]. It is worth mentioning that most of the vegetable cultivation is being done under conventional farming system where huge quantities of chemical inputs are used annually causing threatening death tolls annually which are a challenge for policy makers, farmers and agriculturalists[4]. It is a fact that organic agriculture is the only hope for sustainable food production. It concentrates on recycling methods, with low inputs and high output techniques. Gradually enhancing the soil fertility and diversity at all levels is based on integrated system of all components of agriculture. Additions of farmyard manure (FYM) to organic systems have been shown to enrich SOM directly and indirectly through improved soil properties such as increased numbers and distribution of soil macroaggregates, microfauna, macro and micro nutrients and improved crop yields[5,6]. Research on organic production systems, which rely on mechanical weed management and the incorporation of green manures and FYM, have often shown increase in weed seed as a result of viable weed seed return via incorporation of manures and reduced efficacy of mechanical over chemical weed control during the transition[7,8].

Organic vine vegetables when planted in late summer during rainy season get badly infested with weeds, pests and diseases. These stresses affect productivity of these vegetables. Moreover, early winter conditions limit their growing season short which ahs negative effects on their yields. However, if managed properly, these vegetables may yield high returns. Use of low walk-in tunnel structure may be cost effective and more beneficial. However, problems associated with this technology include different diseases and pest infestations along with stunted plant growth.

The aggregation of soil is an essential function in soil physicochemical and biological processes, and has been shown to influence soil quality through the protection of existing soil organic matter (SOM), moisture holding capacity and soil nutrient retention[9]. During transitioning from inorganic to organic vegetable production, where pest and disease pressure is high, conventional pest management tactics can be applied along with organic techniques to reduce pest and disease pressure[10,11].

The objectives of this study were to develop management strategies of organic vegetables under low tunnels and open fields and comparison of productivity and profitability of organic vegetables.

MATERIALS AND METHODS

The research study was conducted at National Institute of Organic Agriculture (NIOA), NARC; Islamabad, Pakistan during the year 2011-12. Vegetables include long gourd (*Lagenaria siceraria*), Bitter gourd (*Momordica charantia*), sponge gourd (*Luffa cylindrica*) and farash bean (*Phaseolus vulgaris*). The seedlings were planted in first week of July under plastic walk-in-tunnels. The walk -in- tunnel was (1.8288m) high with total area of (409651m) with plant to plant and row to row distance of 56 and 240cm respectively .There were 60 plants in each row for long gourd and bitter gourd, where as 90 plants of sponge gourd and 45 plants of farash bean were planted. The same number of plants was planted on ridges in open field. Total 300 kg of leaf compost was applied to the experimental field before the sowing, manual hoeing was done and the compost was placed near the lower part of the stems which gives slow and continuous release for plant use. For the control of red pumpkin beetle, and other insects on the vegetable plants, wood ash and organic pesticides were used. The data were recorded and Yield was recorded on harvesting basis.

RESULTS AND DISCUSSION

Results regarding all six characteristics showed significant differences among the treatments (Table 1). The largest numbers of seeds germinated of T3 Sponge gourd (590) and it was followed by T1 Long gourd (485) and T2 Bitter gourd and T4 Frash been seed germination % and number of branches showed non – significant difference and after 8 days T1 showed nil number of branches. During the season of monsoon rains the climatic conditions were continuously changing.

Control of red pumpkin beetle on vine vegetables

Red Pumpkin Beetle (*Aulacophora foveicollis*) attacks on vine vegetable, bitter gourd seedlings were badly affected and their leaves are very bitter. (Thapa 1992) concluded that infestation of red beetle was high on watermelon (6-24 adults per plant).Among ten species of cucurbits tested in seedling stage under free choice condition; bitter gourd seedlings were completely safe.

The data showed that the long gourd and F.Beans were highly preferred (100%) and (75%) while sponge gourd was least preferred. It is notable that Bitter Gourd remained free from the attack of Beetle.

The successful control was achieved by dusting wood ash on the affected vegetables. The ash got from burning of wood or dry dung is a good control of Red Beetle. In the morning, the effected plants were dusted with ash in a piece of cloth which was stick on the plant leaves early in the morning in the presence of dew drops. This practice was revised after one week and gave good results from the attack of Beetle. 98 percent control was achieved against R. Beetle on Long gourd and F.Bean while 100 percent successful was achieved on sponge gourd. Surely, it is the excellent method of treatment which is being done by the farmers in Pakistan from ancient times. Moreover, wood ash protects various delicate vegetable plants from propagation of various harmful larvae like Lepidoptera etc. Although many insecticides have been recommended for effective control of red pumpkin beetle[12].

Total long gourd production was 83kg and marketable production was 77kg as compared to open field at 57.5kg during 15 pickings. While production of Bitter gourd remained 19.1kg during 6 pickings in tunnel structure while it gave only 06.45 kg production in flat sowing. The growing speed of bitter gourd plants remained very slow and it was badly damaged due to the attack of fruit fly.

The production of farash bean was 40.2 kg under tunnel structure during 11 pickings and the production in flat sowing was 35.1kg. Among described that organic farms typically have lower levels of most available plant macronutrients, especially inorganic nitrogen[13].

CONCLUSION

Organic vegetable production in low input system is based on a rich soil which provides a conducive capacity for plant growth, nourishment and good resistant against soil borne harmful diseases. It also includes plant protection techniques to prevent damages due to noxious organisms. The data obtained in the experiment suggest that substantial production can be made towards more hopeful and low in-put production systems.

Table 1: Data regarding seedling and its transplanting at organic fields at NARC 2011.

No. of Treatments	Name of vegetable	No. of tubes with seeds	Shifting Month	No. of seeds Germinated	Germi-nation (%)	Temp. (Av)	Vine length (cm)	No. of branches
1	Long gourd	500	August	485	97	35	20.16	0
2	Bitter gourd	400	August	350	87.5	35	14.1	2
3	Sponge gourd	600	August	590	98	35	50	3
4	Farash bean	300	August	293	98	35	18	2

Table 2: Attack of red pumpkin beetle on vine vegetables showing intensity.

S. No.	Name of Vegetable	Month of Attack	Intensity (%)	Pest per plant	Percentage of infestation	Damaged area of plant
1	Long gourd	August	100	5-9 adults	40	New leaves
2	Bitter gourd	August	0	0	0	0
3	Sponge gourd	August	6	0-1	15	New buds
4	Farash bean	August	75	2-3	27	Old and new leaves

Table 3: Data regarding management of red pumpkin beetle on vine vegetable.

S. No.	Name of Vegetable	Quantity of ash /plant (g)	Age of the plant (days)	No. of Application done	Control (%)	Mode of action of wood ash observed
1	Long gourd	3-7	40	2	98	Repellent
2	Bitter gourd	0	40	0	0	NA
3	Sponge gourd	3-5	40	2	100	Repellent
4	F.Bean	3-7	40	2	98	Repellent

Table 4: Harvesting and economics.

Vegetable	Vegetable harvesting time	Tunnel				On open field				Difference (Rs.)
		pickings	Qty (Kg)	Damaged (Kg)	Amnt (Rs)	Pickings	Qty	Damaged (Kg)	Amnt (Rs.)	
L. gourd	29.09- 13.12	19	77.0	6.0	2130	15	54.5	3	1545	585.0
B. gourd	7.10-14.11	6	13.6	5.5	1215	5	5.85	0.600	78.75	1136.2
S. gourd	29.09-18.11	12	18.4	2.2	276	7	4.55	1.500	53.25	222.25
F. bean	07.10-12.12	11	39.4	0.8	1576	7	34.9	0.500	1376	200

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