

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 French beans, were grown under walk-in tunnels and open field conditions. Vegetable seedlings grown in the first week of July, in polythene tubes, were shifted during the first week of August in open fields. Enriched compost @100kg/acre was used in furrows in the plots in two split doses. The results revealed that long gourd, bitter gourd, sponge gourd and French beans yielded 2495.62, 440.78, 596.35 and 1276.97 kg/acre, respectively, as compared to the vegetables in open field condition with the production of 1766.37, 189.59, 147.46 and 1131.13 kg/acre, respectively.

Keywords: Organic, Off-season summer vegetables, Walk-in tunnels, Open field, Management techniques.

Introduction

Pakistan's diverse conditions provide an opportunity of growing vegetables and there has been a gradual increase in both area and production of vegetable crops for the past three decades. Out of a total 20.43M hectare of arable land of Pakistan, the area under vegetable cultivation was 0.41M hectare in 2010-2011 and during 2009-10, the area under vegetables was 0.38M hectare (GOP, 2011). This shows that a large number of summer and winter vegetables are grown in Pakistan throughout the year.

Vegetables are low in fat but contain a good quantity of minerals and vitamins. Vegetables help the body to protect it from oxidative stress and different diseases and different types of cancers. The use of vegetables also helps in the development of immunity to fight against these diseases. They also contain soluble and insoluble dietary fiber, like, gums, cellulose, pectin, etc., which absorb excess water in the colon and help the easy passage of fecal matter out of body (Lilly, 2012). Nature of various food materials and 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 of the food shortage but also contributes to the requirement of necessary nutrients for the body (Usha and Goyal, 2011).

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 resulting in a large number of deaths annually. This is a big challenge for policy makers, farmers and the agriculturalists (Rebecca, 2011).

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. It gradually enhances the soil fertility and diversity, which is based on integrated system of different components of agriculture. The additions of farmyard manure (FYM) to organic systems have shown the enrich of soil organic matter (SOM) directly and indirectly because it improves soil properties, i.e., increased number and distribution of soil macro aggregates, microfauna, macro and micro nutrients results in improved crop yields (Edmeades, 2003; Mikha and Rice, 2004; Jiang et al., 2006). Research on organic production systems, which depends on mechanical weed control and incorporation of green manures and application of FYM, have often shown increased weed seed incorporation into the soil by the use of manures (Huxham et al., 2005; Riemens et al., 2007). Organic vine vegetables often planted in late summer during the 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, which has negative effects on their yields. However, if managed properly, these

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vegetables may give higher yield. In this regard, use of low walk-in tunnel structure may be cost-effective and more beneficial, although problems associated with this technology include different kinds of diseases and pests 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 SOM, moisture holding capacity and soil nutrient retention (Angers and Caron, 1998; Jiao et al., 2006). During transitioning from inorganic to organic vegetable production, where pests and disease pressure is high, conventional pest management tactics along with organic techniques can be helpful in the reduction of pest and disease pressure (Wilson et al., 2012). The objectives of this study were to develop management strategies of organic vegetables under low tunnels as well as open field conditions and compare 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 included long gourd (*Lagenaria siceraria*), bitter gourd (*Momordica charantia*), sponge gourd (*Luffa cylindrica*) and French bean

(*Phaseolus vulgaris*). The seedlings were planted during the first week of July under plastic walk-in-tunnels. The walk-in-tunnel was 1.83m 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, 90 plants of sponge gourd and 45 plants of French bean. 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. To control red pumpkin beetle (*Aulacophora foveicollis*) and other insects on the vegetable plants, wood ash and organic pesticides were used. Different data, including, yield, were recorded on harvesting basis of RCBD experiment design.

Results and Discussion

Results regarding all six characteristics showed significant differences among the treatments (Table 1). The largest germination was recorded in T3, i.e., sponge gourd, having 590 kg/1344 sq.ft area and it was followed by T1 (long gourd) (485) and T2 (bitter gourd) and T4 (French bean). Number of branches showed non-significant differences and after 8 days, T1 showed nil branches. During the monsoon season, the climatic conditions observed were continuously changing.

Table 1. Data regarding seedling and its transplanting in Organic fields at NARC in 2011-12

Treatment	Name of vegetable	No. of tubes with seeds	Shifting Month	No. of seeds Germinated	Germination (%)	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	French bean	300	August	293	98	35	18	2

Attack of red pumpkin beetle on vine vegetables

The results of control of red pumpkin beetle are presented in Table 2. Red pumpkin beetle severally attacked the bitter gourd seedlings. Thapa and Neupane (1992) concluded that infestation of red beetle was high on watermelon, i.e., 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 French 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.

Table 2. Attack of Red Pumpkin Beetle on vine vegetables showing intensity.

Treatment	Name of Vegetable	Month of Attack	Intensity (%)	Pest per plant	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	French bean	August	75	2-3	27	Old and new leaves

Control of red pumpkin beetle on vine vegetables

The successful control was achieved by dusting wood ash on the affected vegetables as presented in Table 3. The ash obtained from burning of wood or dry dung is a preventive measure against red beetle. In the morning, the affected plants were dusted with ash in a piece of cloth which stucked 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 the beetle.

98% control was achieved against red beetle on long gourd and French beans while 100% success was achieved on sponge gourd. Surely, this method is being practiced by the farmers in Pakistan since ancient times. In addition to it, wood ash also protects various delicate vegetable plants from propagation of various harmful larvae, like Lepidoptera, although many insecticides have been recommended for effective control of red pumpkin beetle (Mahmood et al., 2006).

Table 3. Data regarding management of Red pumpkin Beetle on vine vegetable.

Treatment	Name of Vegetable	Quantity of ash/plant (g)	Age of the plant (days)	No. of applications	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	French Bean	3-7	40	2	98	Repellent

Harvesting and economy

The harvesting and economic data has been presented in Table 4. Total long gourd production was 2690.08 kg/acre as compared to open field at 1863.61 kg/acre during 15 pickings. Production of bitter gourd remained at 619.04 kg/acre during 6 pickings in tunnel structure, while yields were only 209.04 kg/acre in flat sowing during 5 pickings. 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 sponge gourd in tunnel structure was 667.65 kg/acre during 12 pickings while at open field, the production was 196.08 kg/acre in 7 pickings. The production of French

bean was 1302.91 kg/acre under tunnel structure during 11 pickings and the production in flat sowing was 1147.34 kg/acre among Condron et al. (2000) and Munro et al. (2002) described that organic farms have lower levels of most available plant macronutrients, especially inorganic nitrogen.

Conclusion

Present study revealed that long gourd produced maximum production in tunnel and in open field as compared to bitter gourd, sponge gourd and French bean. It is recommended that organic vegetable production may be increased by the application of organic fertilisers as safe food.

Table 4. Harvesting and economic data

Treatment/ Vegetable	Vegetable harvesting time	Tunnel				On open field				Difference (Rs)
		No. of pickings	Qty (kg)	Damaged (kg)	Amnt (Rs)	Pickings	Qty	Damaged (kg)	Amnt (Rs)	
Long gourd	29.09 - 13.12 – (2012)	19	77.0	6.0	2130	15	54.5	3	1545	585
Bitter gourd	7.10 - 14.11 – (2011)	6	13.6	5.5	1215	5	5.85	0.600	78.75	1136.25
Sponge gourd	29.09 - 18.11 – (2011)	12	18.4	2.2	276	7	4.55	1.500	53.25	222.75
French bean	07.10 - 12.12 – (2012)	11	39.4	0.8	1576	7	34.9	0.500	1376	200

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