Residual effect of organic manure on growth and yield of *Vigna unguiculata* (l) Walp and *Lablab purpureus* L.

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ABSTRACT

A field experiment was carried out in the Research farm located in the Botanical garden of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad to study residual effect of organic manures on growth and yield of *Vigna unguiculata* (L) walp and *Lablab purpureus* L. Organic manures were prepared like green manure of *Achyranthes* (GMA), green manure of *Parthenium* (GMP), mixed green manure of both (GMPA), Dry powder of *Achyranthes* (DPA), Dry powder of *Parthenium* (DPP), compost of *Achyranthes* (COA) and compost of *Parthenium* (COP). These manures and chemical fertilizers PK and NPK were supplied to field for maize crop cultivation. Subsequent to harvesting of maize crop after 23 days of interval *Vigna unguiculata* (L) walp and *Lablab purpureus* L. was sown in the same plots in an alternative row manner. The growth analysis of the both the crops was recorded after 59 days. Harvesting of both crops was carried out and fresh weight per plot was noted. Samples of each treatment along with control were kept in oven for estimation of dry matter, nitrogen, crude protein, phosphorus, potassium and total reducing sugar. Percent increase over control and nitrogen efficiency ratio was also calculated. All organic manures showed good residual effect on growth and yield of both the crops. Compost of *Achyranthes* showed highest residual effect on *Vigna unguiculata* while compost of *Parthenium* gave highest residual effect on *Lablab purpureus.* Organic manures prepared from weeds increases the productivity of crop and show long term effect.

Key words: compost, growth, organic manures, residual effect, yield.

INTRODUCTION

Green revolution started in early sixties with the introduction of high yielding varieties, chemical fertilizers and pesticides in our country to boost up agricultural production. Green revolution had played a major role; abundant use of chemical fertilizers has resulted in increase of salinity, decrease in porosity and poor soil health (Singh and Shekhawat, 2000). Apart from this, the accumulation of free nitrates coming from the highly soluble nitrogenous fertilizers and pesticide residues have created water pollution leading to carcinogenic effect on human body and damage of important organs, imbalance of soil reaction and nutrient supply had caused reduction inbuilt plant resistance against pests. Recent record-high prices of chemical fertilizer (Agriculture and Agri-Food 2008) have made the fertilizer option unattractive, and have increasingly turned attention to organic amendments, such as organic manures (Larney and Angers 2012).There is a huge interest to apply organic matters due to it's high nutrient content (Bittman *et al*., 2004). Manures, in the wide sense refers to all substances added to the soil in order to increase the supply of plant nutrients (Ahn, 1993). Organic manures supplies most of the nitrogen, sulphur and half phosphorus needed by unfertilized crops (Hseih, 1996). Integrated use of organic manures and fertilizers has been found to be promising not only in maintaining higher productivity but also for providing stability in crop production. Long term manorial experiments conducted in India showed a declining trend in productivity with application of N.P. and K fertilizers alone (Nambiar and Abrol, 1989). The decline in productivity has been associated with the onset of deficiencies of nutrients like sulphur and zinc.

Organic manure can be applied to all crops not only maintaining higher productivity but also improve molecular size of soil (Ellerbrock and Hoehn, 1999). An application of manure usually shows a favorable influence on crop yields for several years. Greater efficiency of manure is obtained when applied in small amounts and more often (Gibberd, 1995).These beneficial effects are distributed over a longer time than those of chemical fertilizers. Use of organic manures such as compost, vermicompost, dry leaf powder on growth and yield of crop was also studied and result into increased productivity (Naikwade *et al*., 2011a, 2011b Ghadge *et al*., 2013).

In long term manuring experiment on a permanent plot in India, Rayer (1986) observed that organic carbon, total nitrogen, exchangeable calcium and magnesium showed some sort of stabilization in the equilibrium in soil. Direct and residual effects of organic manures were studied by Bodruzzaman *et al*. (2002) on yield in a wheat-rice cropping pattern. Long term application of Organic manures increased sugarcane yield (Yadev and Prasad, 1992). Direct and residual effect of zinc and zinc amended organic manures on nutrition of field crop was studied by (Gupta and Handore, 2009). Application of organic manures increases soil fertility and other properties (Karami *et al.*,2009, Mkhabela and Warman, 2005). Tejada *et al*. (2009) reported positive effects of adding composted plant residues, soil physical (structural stability, bulk density), chemical (C/N ratio), and biological (microbial biomass, soil respiration and enzymatic activities) properties. Residual effects of organic fertilizers on chemical properties of soil was studied by Tabibian *et al*.(2012) and found significant increase in organic matter, electrical conductivity. Organic amendments play a residual role in their ongoing maintenance. Residual amendment effects on total nitrogen (N) and phosphorus (P) were apparent 11.5 yr after application (Larney, *et al*., 2011). Present investigation was carried out to study comparative residual effect of organic manure such as compost, green manure and dry leaf meal. Effect was studied on growth and yield of *Vigna unguiculata* (L) walp and *Lablab purpureus*

MATERIALS AND METHODS

A field experiment was carried out in the Research farm located in the Botanical garden of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.

Common weeds *Achyranthes aspera* L. belonging to Amaranthaceae and *Parthenium hysterophorus* L. belonging to Asteraceae family were collected from campus, brought to laboratory and chopped into small pieces (2-3cm) by iron cutter. Equal amount (13333 kg/ha) of weed vegetation was used for use as green manure and for preparation of compost and dry powder. Organic manures were prepared like green manure of *Achyranthes* (GMA), green manure of *Parthenium* (GMP), mixed green manure of both (GMPA), Dry powder of *Achyranthes* (DPA), Dry powder of *Parthenium* (DPP), compost of *Achyranthes* (COA) and compost of *Parthenium* (COP). The process of composting was followed as described by Stoffella and Kahn (2001).

These treatments along with chemical fertilizers PK and NPK were applied to research plot of size 1x1 m of research farm in a randomized block design (RBD). The fodder maize (Zea mays L.) crop was cultivated on treated farm. Subsequent to harvesting of maize crop after 23 days of interval *Vigna unguiculata* (L) walp and *Lablab purpureus* L. was sown in the same plots in an alternative row manner. Both varieties cowpea and wal were a recognized company marketed by Patel Seeds Corporation, Old Mandi P.O. Padra (Baroda, Gujrat). Frequent irrigations were given as per requirement.

After 59 days growth analysis of the plant was recorded. Finally the total crop *Vigna unguiculata* harvested after 72 days of sowing and *Lablab purpureus* was harvested after 72 days of sowing each plant fresh weight per plot was noted. Samples of each treatment along with control were kept in oven for further chemical analysis. Ash values were obtained by burning the moisture-free samples in a muffle furnace at 600°C for 2 hours and calcium (Ca) Content was analyzed by titrating the acid soluble ash solution against 0.01 N $KMnO_4$ solution using methyl red as indicator (AOAC, 1995). Nitrogen (N) was estimated by micro-Kjeldahl method after digesting the sample with Conc. H_2SO_4 (Bailey, 1967) and crude protein (CP) was then calculated by multiplying N value with 6.25 as specified by AOAC, (1995). The dry samples were boiled in distilled water, filtered and amount of water soluble reducing sugars was determined in the filtrate by using Folin-wu tubes (Oser, 1979).

The amount of phosphorus was measured following Fiske and Subba Rau (1972) as described by Oser (1979). Potassium (K) Content was determined on a flame photometer (model Mediflame- 127) as suggested by Jackson (1973). All the results were statistically analyzed using analysis of variance (ANOVA) test and treatments means were compared using the least significant difference (C.D., p = 0.05) which allowed determination of significance between different applications (Mungikar, 1997) .

RESULTS AND DISCUSSION

Table No. 1 shows the growth analysis of *Vigna unguiculata* and *Lablab purpureus,* after 59 days. Plant height of *Vigna unguiculata* was maximum in the treatment of *Achyranthes* compost (COA), followed by other organic treatment and lower in chemical fertilizer treatments and minimum in control. Same pattern is followed in case of stem weight, leaves weight, total weight. In a fodder crop the leaves are important. The weight and number of leaves were maximum in the plant on *Achyranthes* compost as 11.9 gm and leaves 13 and minimum in the control as 2.80 gm and leaves 5 respectively. In case of *Lablab purpureus* maximum plant height was recorded in the plant of green manure *Parthenium* followed by other organic treatment and lower in chemical fertilizer treatments and minimum in control. Stem weight was highest in the treatment of COA and GMA however weight of the leaves was maximum in COA. No. of leaves were highest in GMA, DPA and COP as 16 for each plant.

When age of plant was 72 days *Vigna unguiculata* was harvested. At the time of harvesting plant height was highest in the treatment of *Achyranthes* compost followed by GMA, DPA, COP, GMPA, NPK, GMP, DPP and very dwarf recorded in the treatment of control. Total plant weight was highest in COA followed by GMP, COP & DPA. The stem weight was maximum in GMP and minimum in control. In a fodder crop leaves are very important part contain comparatively high protein. Weight of the leaves was highest in COA followed by other treatments.*Lablab purpureus* plant was harvested when the age of plant was 74 days. Plant height was highest in the GMP followed by other organic manures and lowest in control. Total plant yield was maximum in the treatment of COA followed by GMA, GMP, GMPA, NPK, COP, DPP, PK and control. Weight and no. of leaves were maximum in COA and minimum for control. Organic manures significantly increased plant height over the control plants these results confirmed the findings of Ofosu and Leith (2009). The application of different OM showed a significant increase in plant height and number of fruits plant of chilli (Dileep, 2005).

Residual effect of organic manures on crop yield is given in Table No. 2. It shows that *Vigna unguiculata* dry matter percentage was highest in the treatment of dry powder of *Parthenium* and lowest in the compost of *Achyranthes.* Nitrogen percentage was highest in the green manure of *Achyranthes* and minimum in the plant of control. Total reducing sugar percentage was maximum in *Achyranthes* it was lowest in control followed by NPK. *Lablab purpureus* shows maximum dry matter percentage in *Parthenium* green manure and minimum in the PK and COA. Total reducing sugar percentage was maximum in DPA and minimum in NPK. Table No. 3. demonstrate the increase over control kg/ha of crop plant. Fresh vegetation increase over control kg/ha of *Vigna unguiculata* was highest in the treatment of compost of *Achyranthes* (COA) followed by green manure of *Achyranthes* and *Parthenium*, other organic manure treatments. Total sugar kg/ha increase over control was highest in the treatment of COA and lowest in NPK. In case of *Lablab purpureus* maximum yield was recorded in the treatment of COP followed by GMP, GMPA, COA, GMA, NPK, PK and DPP. Nitrogen kg/ha increase over control was maximum in the treatments of COP and lowest in DPP. It shows that Dry leaf of *Parthenium* will not work well because of its high moisture content and its tendency towards the decaying rather then drying. Total reducing sugar kg/ha was highest in the treatment of GMP and minimum in the treatment of NPK.

Residual effect of organic manures particularly the compost of *Achyranthes* show long term effect on *Vigna unguiculata* and result into increased productivity. Second alternative crop *Lablab purpureus* was effective against compost of *Parthenium.* It shows that compost of weed gives long term residual effect on crop plant and it improves the soil quality. These findings are in accordance with in Rekhi *et al.* (2000) who showed good results of green manure and other organic manures on rice-wheat cropping pattern.

Kaushik *et al* (1984) showed that organic manures have good residual effect on yield of crop in paddy wheat rotation. Campbell *et al* (1986) and Cremenscu *et al* (1985) reported that organic manures have positive effect in crop yield. Budher *et al* (1991) obtained higher rice yields with organic manures. Positive influence on growth and yield derived from the residual effect due to increased fertility, higher values of soil organic matter, organic carbon, cat ion exchange capacity and soil chemical properties (Gana, 2009).

Table 1. Growth and analysis of crop plants, on residual effect of weeds manure characteristics.
(Age of Plant – 59 days)

Obs. No.	Treatments	*Vigna unguiculata* (L) Walp. Chawali					*Lablab purpureus* L (Wal)				
		Plant height (cms)	Total plant wt (gms)	Stem wt. (gms)	Leaves wt. (gms)	No. of leaves	Plant height (cms)	Total plant wt. (gms)	Stem wt. (gms)	Leaves wt. (gms)	No. of leaves
1	CON	42.33	07.16	4.3	2.80	05	45.6	11.0	07.0	4.0	09
2	PK	71.66	14.86	9.3	9.56	08	73.6	18.3	11.6	6.6	12
3	NPK	80.00	12.73	7.5	5.23	09	77.3	22.0	13.6	8.3	13
4	GMA	91.33	16.03	8.6	7.43	12	91.3	95.6	16.0	9.6	16
5	GMP	80.00	19.36	11.0	8.36	11	99.0	21.0	13.0	8.0	12
6	GMPA	86.66	18.33	9.3	9.00	10	86.3	18.3	10.3	8.0	12
7	DPA	88.66	15.66	9.0	6.60	09	95.0	23.3	12.6	10.6	16
8	DPP	70.33	18.30	10.3	8.00	10	81.7	15.0	09.0	6.0	14
9	COA	96.33	25.46	13.6	11.8	13	88.0	28.33	16.0	12.3	14
10	COP	88.00	18.46	10.3	8.16	08	86.3	22.0	12.0	10.0	16
Age of the plant 72 days							**Age of the plant 74 days**				
1	CON	46.66	10.22	06.1	4.12	06	63.3	17.7	11.0	06.7	15
2	PK	72.66	16.33	10.0	6.30	11	75.6	25.5	15.3	10.2	17
3	NPK	90.66	18.33	9.6	8.73	14	95.0	28.0	16.7	11.4	18
4	GMA	98.00	21.88	12.0	9.88	16	117.3	38.8	23.3	15.5	21
5	GMP	83.66	28.33	16.0	12.33	14	120.6	37.3	26.0	11.7	22
6	GMPA	94.00	21.55	12.3	9.25	14	115.0	32.9	22.3	10.6	20
7	DPA	97.33	20.00	10.6	9.30	14	94.0	26.8	14.3	12.5	16
8	DPP	76.33	22.44	12.0	10.44	12	91.3	26.6	15.0	11.6	22
9	COA	101.3	30.77	15.6	15.11	16	93.3	39.1	21.6	17.5	26
10	COP	96.00	23.44	13.3	10.11	12	96.0	26.9	14.6	12.3	21

Table 2: Residual effect of organic manures on *Vigna unguiculata* crop yield. (Age of the plant – 72 days)

Obs. No.	Treatments	Dry matter %	Nitrogen %	Crude protein kg/ha	Phosphorus %	Potassium %	Total Red. Sugar %
1	CON	16.00	1.58	050.07	0.071	0.873	1.45
2	PK	15.16	2.08	095.50	0.094	0.970	1.75
3	NPK	16.00	1.94	069.00	0.097	0.970	1.63
4	GMA	16.33	2.13	118.38	0.095	0.921	2.08
5	GMP	16.33	1.80	100.07	0.093	0.907	1.90
6	GMPA	16.33	2.05	100.00	0.111	0.907	1.83
7	DPA	16.16	2.11	084.44	0.110	0.970	2.16
8	DPP	17.66	1.80	069.75	0.106	0.951	1.75
9	COA	15.00	2.02	107.94	0.097	0.951	2.20
10	COP	16.16	2.08	105.070.	0.110	0.951	1.90
	S.E.			014.30			
	C.D.			035.01			

Table 3: Percent increase over control of *Vigna unguiculata* (L). Walp

Sr. No.	Treatments	Increase over control kg/ha of *Vigna unguiculata*				Increase over control kg/ha *Lablab purpureus*			
		Fresh vegetation	Dry matter	Nitrog-en	T.Red Sugar	Fresh vegetation	Dry matter	Nitrogen	T.Red Sugar
1	CON								
2	PK	1677	228	7.27	5.51	145	60	1.63	3.09
3	NPK	388	62	3.03	1.93	289	97	2.95	1.87
4	GMA	2277	382	10.93	11.15	845	221	6.93	9.29
5	GMP	2277	382	8.0	9.55	1367	330	7.02	10.2
6	GMPA	1611	273	7.99	6.93	1222	289	6.75	8.81
7	DPA	500	85	5.5	5.45	178	71	2.46	5.36
8	DPP	344	113	3.15	3.5	67	75	1.23	4.14
9	COA	2533	348	9.26	11.46	1178	236	6.27	6.64
10	COP	1833	301	8.8	8.0	1478	303	8.01	6.99

One of the major reasons is addition of nutrients in soil due to application organic manures. Bharadwaj and Omanwar (1994) reported that application of organic manures increased available N, P, K in soil. Sharma and Saxena (1985) reported that organic manures improved phosphorus in soil. A great part of the virtue of organic manures lies in their slow mineralization and the addition of organic matter to the soil, which they produced, offers a definite advantage over soluble fertilizers (Lakshmikathan, 1983). The increase in the yield may be due to increased organic matter in soil due to residual effect of manures (Pais and Benton Jones, 1997).

Diacono and Montemurro (2010) reported that addition of exogenous organic matter to cropland can lead to improvement in soil biological functions for >15 yr after spreading, Larney *et al*. (2009) proposed that increased productivity is due to manure addition, self-perpetuating the amendment effect. This may have been coupled with an improvement in soil physical properties as reported by Arriaga and Lowery (2003). Larney *et al*. (2005) hypothesized that once soils are given an initial boost by addition of organic manure, the effect may be self-sustaining.

These results confirm that organic fertilizers have a larger residual effect than mineral ones. Though both the plants were grown side by side in the same plot still they have responded differently.

For the growth of *Vigna* (Chawali) *Achyranthes* compost and green manure are very good and for *Lablab* (Wal) *Parthenium* compost and green manures are recommended. For sustainable agriculture and long lasting productivity careful long term management is required. One time application of weed manures help to restore functionality, enhance crop productivity for many years because of considerable organic matter inputs. It will also reduce inputs of N, P and K fertilizer. Chemical fertilizers are leached away and do not show residual effects. Organic manure amendments can be viewed as important step for Sustainable land management with increased productivity.

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