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INFLUENCE OF ORGANIC MANURE (FYM), TWO BIO-FERTILIZERS AND POTASSEIN FOLIAR SPRAY LEVELS ON VEGETATIVE GROWTH TRAITS, TOTAL AND MARKETABLE YIELD OF TARO (*Colocasia esculenta* L. Schott).

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ABSTRACT

Taro (*Colocasia esculenta* L. Schott) is a monocotyledonous plant belonging to the family (Araceace). It is considered one of the most important vegetables grown in Egypt due to its high nutritional and economical values. Local cultivar (Balady) has been put under investigation to study the effect of different levels of (Farmyard manure) (40,80 and 120 m^3/Fed), two bio fertilizers. i.e (nitrobein, phosphorein) and potassein foliar spray during 2000 and 2001 years, on plant growth, yield and its components as well as chemical constituents in corms. In general, all the studied charactes were better in plants receiving FYM levels. Increasing the applied FYM rate from 40 to 120m^3/Fed. significantly increased most parameters. Moreover the best results were obtained by using potassein foliar spray compared with nitrobein and phosphorein. The application of FYM (120m3/Fed) combined with potassein foliar spray increased total yield/Fed by 18.97 and 23.31 ton/Fed in 2000 & 2001 years, respectively. The same combination gave the highest dry weight. Fertilization of 120m^3/Fed FYM with nitrobein and 80 m^3/Fed with potassein were the optimum rates to maximize corms dry weight. The obtained data indicted that application of FYM or potassien foliar spray caused significant increase of starch, protein and NPK in the corms. While potassien and nitrobein treatments didn't show a significant effect on protein and starch percentage. Applying nitrobein gave higher phosphorus percentage and phosphorein gave the highest potassium percentage.

INTRODUCTION

Taro (*Colocasia esculenta* L. schott), is a member of family Araceae and belongs to sub-tribe colocasieae. Taro has been known in Egypt from over 2500 years, (Marishita, 1988)., where, Taro occupies considerable acreage specially in Menoufia, Qalubia and Assuit Governorates. Statistical data showed that the total area was 5865 feds. and produced 74872 tons with an average of 12 77 Ton/Fed. [Ministry of Agriculture Statistics (2001)]. Organic manures or organic substrates must be added to improve the chemical and physical properties of the soil, reducing PH and EC, increasing soil organic matter content and release of nutrient elements. Soils of high organic matter are recognized as fertile, because of constantly release of nutrients during the time of decomposition (Balba, 1973 and Salem 1986). In addition, organic manures stimulate biodegradation through increasing the population and activities of micro-organisms in the soil (Parr, 1975; Meravat and Dahdoh, 1995). In addition, organic matter considered as builders of better soil and create of favorable biological reactions and life in the soil (Wallace, 1994).

The heavy use of chemical fertilizers have resulted in serious

problems in the soil not as for salinity, but also and more importantly for the pollution of the underground waters and the accumulation of the chemicals in the plant tissue which is a major component of animal fodder and human diet.

Fisher and Richter, (1984); Borin *et al.*(1987) and Browaldh (1992) reported that organic manure is a rich and a slow release fertilizer which usage leads to a clean product of plants. Increasing yield production is the ultimate aim of researchers, However, soil fertility maintenance is of importance, with respect to its physical, chemical and biological properties. Moreover, Organic manure has an obvious effect in reducing environmental pollution through clean agriculture. Moreover, the demand increase of organic products has also been an incentive for producers in sub-tropical countries to start organic production for export.

The prices of the organic products are on average, 30-100 percent more than trade the prices for conventionally grown products.

The market for organic products has developed rapidly since 1980 's, especially in Europe and U.S. The growth of organic farming in due to increasing consumer demand for (Safe) food products and to the rising concern about more sustainable agricultural production.

Developing countries have also become interested in organic agriculture for export as well as for local market. Several workers have reported the effect of Farmyard manure (FYM) on vegetative growth characters and yield. Almeid *et al.* (1984) showed that applications of 30 Ton organic manure/ha on Taro increased head and sprout weight by 28 and 33% respectively. Also, Purea *et al.*(1996) reported that organic fertilizer generally increased Yam yield compared with NPK. Escalada and Ratilla (1998), with Taro application of green manure (7.23 or 10.84 t/ha)2.5m^3 promoted vigorous stand growth and a higher total corm yield and marketability than control (untreated).

Nowadays, intensive crop cultivation requires the use of chemical fertilizers. Which are not only in short supply but also expensive for the developing countries. Therefore, (the current trend is to explore the possibility of supplementing chemical with organic ones more particularly bio fertilizers of microbial origin). (Brown *et al.*, 1964 and Carletti *et al.*, 1996. El-Haddad *et al.*(1993) reported that Bio-fertilizer application is considered a promising alternatively for chemical fertilizers under local conditions.

As a result of the miss use of chemical fertilizers, the natural biological balance in the soil was disturbed. The use of bio-fertilizers was suggested to be one possibility to restore the natural conditions. Bio-fertilizers mainly consist of beneficial micro-organisms make them available for economical plants.

The use of bacteria with combination of organic fertilizers resulted in encouraging yields and helps to keep the environment clean for our coming generations. No information is available on the frequencies and magnitude of taro responses to Bio fertilizer application. However, taro grows and yields better in moist environments but can be cultivated under a wide range of moisture regimes (Wilson 1984), However, under tropical conditions, thus, this work was conducted as a first step towards organic farming of vegetable crops and to determine the optimum organic fertilizer levels for taro plants. It

also aimed to study the effect of potassein and Bio-fertilizers on vegetative growth, yield, quality and chemical analysis. Finally, Organic vegetable production is an ultimate target of such studies of the influence of (FYM) on taro production.

MATERIALS AND METHODS

Two field experiments were carried out at Barrage Horticultural Research Station during the years 2000 and 2001 growing seasons.

A split plot design was used in three replicates. Three levels of organic (FYM) at the rates of 40,80 and 120m^3/Fed were devoted to the main plots, while potassein, Foliar spray by 2500 PP Potassein (zero N:10 p_2o_5 : 30k_2o), two bio-fertilizers i.e. nitrobein (a commercial name in Egypt, is a bio-fertilizer containing live cells of efficient bacteria strain for N.fixation in cultivated soil was used) It was supplied 8Kg/Fed, fixed with wet soft soil (1:10 ratio) into the root absorption zone of the plant, phosphorein (a commercial name in Egypt, phosphorus solubilizing bacteria (PDB). It was supplied 5Kg/Fed, fixed with wet soft soil (1:10 ratio) into the root absorption zone of the plant and applied before planting and during soil prepartion and control treatment represented the sub-plots. The plot area was 50m_2 comprising 10 rows, Each row one meter width and five meters length, corms were planted in hills 50 cm apart. Other agricultural practices were applied as recommended by Ministry of Agriculture. Corms of *Colocasia esculenta* local cv. Balady were planted on March 20th, 2000 and March 18th 2001, Chemical analysis of the soil and FYM were carried out, and results are presented in Tables (1) and (2).

Table (1) :Physical and chemical analyses of the soil.

I- Mechanical analysis	2000	2001
Clay	16.55	16.25
Silt	8.69	8.55
Fine sand %	32.90	31.95
Coarse sand %	41 85	41 54
II- Soil chemical Analysis Texture	Sandy-clay	Sandy clay
PH	8.8	8.4
Ec m. mohs	2.824	2.815
Water Holding capicaty%	32.5	32.7
Organic mattter %	1.05	2 00
Total N %	0.110	0.115
P mg/100 g	12.6	11.9
K^+ mg/100g	4.63	4.5
Mg^{2+} (ppm)	11.79	11.70
Ca^{2+} (ppm)	15.46	14.95
Na^+ (ppm)	17.59	17.22
So_4^{2-} (ppm)	17 18	17.25
$C1^-$ (ppm	31.21	31.15
Co_3^- (ppm)	1.08	2 00

Table (2) : Chemical analysis of FYM.

FYM			Org. matter %	Moisture %	E.C.	Fe (ppm)	Mn (ppm)	Mo(ppm)	PH
N %	P P_2O_5 mg/100g	K k_2o m/100g							
1.52	0.52	0.86	25	63.25	9.60	3759	353	81	7.23

Recorded Data :

The following data were recorded during the growing season for each treatment using *three plants taken at random*. Vegetative growth characters. i e. plant height (cm), average number of leaves blad, and average leaf area (cm2).Yield and its components. i.e. corms *fresh weight per plant* (kg), Total yield per feddan (kg) number of cormels per plant, average length and diameter of corm (cm) and dry weight % . Chemical analysis starch, protein and N,P,K.

Starch content was determined according to Somogyi (1952) and Nelson (1974).

Protein content was determined as nitrogen content and converted to its equivalent protein content by multiplying with 6.25 *as described by Pregl* (1945).Corm content of nitrogen (Koch & Mc Meckin, 1924, phosphorus (Troug and Meyer, 1939), potassium (Brown & Lilliland, 1946), samples were *dried on the oven at* (65-70 oC for 48 h).

Statistical analysis:

All obtained data were statistical analyzed using a General Liner Model procedure of SAS Institute (1989). Fishers *Protected Least significant* (LSD) at
P? 0.05 was employed to separate the treatment means.

RESULTS AND DISCUSSION

Vegetative growth characters :

Data presented in table (3) showed the influence of organic manure, potassein *and bio-fertilizer on plant* height, average number of leaves blad and, average leaf area. With respect to organic fertilizer treatments, it could be noticed from the data that *plant height, average number* of leave blades and average leaf area tended to increase by increasing organic manure. The differences between traits were significant. However, The *highest rate* ($120m^3$) at the two growing seasons was the best.

This enhancing effect of FYM might be related to its contents of organic *materials. Because it improves* the physical conditions of the soil, provide energy for micro-organisms activity, increases nutrient supply and improve the efficiency of *macro elements as well as its abitily* to meet, nutrient requirements, of the plants (Cooke, 1982; Sahota, 1983; Tisdale *et al.*; 1985; Kolbe *et al.*, 1995; El-Nagar 1996; Arisha and Bardisi, 1999, *and El-Kader*, 2002.

Table (3) : Influence of organic manure (FYM)level, potassein and bio-fertilizer on Taro vegetative growth during 2000 and 2001 seasons .

Season		2000					2001			
FYM level m^3	1	2	3	4	Mean	1	2	3	4	Mean
					Plant height					
40	79.07	88.68	91.66	83.66	85.77	144.6	148.8	151.7	149.5	148.6
80	74.58	117.7	113.8	87.07	98.31	147.0	150.8	155.3	149.4	150.6
120	100.6	119.0	128.1	90.59	109.6	151.7	152.9	154.6	154.6	153.5
Mean	84.97	108.5	111.2	87.11	97.89	147.8	150.9	153.9	151.2	150.9
	FYM				2.408			1.414		
L.S.D 0.05	Bio + Potassein				1.918			0.937		
	FYM + Bio				3.316			1.624		
					Average number of leaf blades					
40	4.677	5.993	5.373	6.077	5.530	6.447	7.347	7.63	6.343	6.942
80	5.293	6.343	6.457	5.667	5.940	6.877	7.57	8.343	7.59	7.595
120	6.577	7.310	7.177	16.293	6.839	7.587	8.353	8.797	8.093	8.207
Mean	5.516	6.549	6.336	6.012	6.102	6.970	7 757	8.257	7.342	7.602
	FYM				0.249			0.109		
L.S.D 0.05	Bio + Potassein				0.264			0.309		
	FYM + Bio				0.457			0.534		
					Average leaf area					
40	366.7	460.5	451.7	426.9	426.4	327.0	504.4	455.6	340.9	407.0
80	376.1	468.5	469.3	453.4	441.8	413.7	579.3	591.7	384.9	492.4
120	361.3	608.4	520.2	477.4	490.6	568.5	639.7	669.5	527.9	601.0
Mean	368.0	512.5	480.4	450.9	452.93	436.4	574.5	572.3	417.9	501.0
	FYM			25.50				16.26		
L.S.D 0.05	Bio + Potassein			24.70				21.81		
	FYM + Bio			42.77				37.78		

1) **FYM + Phosphorein**
2) **FYM + Nitrobein**
3) **FYM + Potasein**
4) **FYM (40,80,120 m^3 / Fed)**

The effect of FYM levels, i.e. 40, 80 and 120m^3/Fed, presented in table (3) showed that the increase in FYM didn't yield an equivalent level of the vegetative growth. In the mean time, these traits differed from year to year. Plant height reached 128% increase with the highest level of FYM (120m^3) as compared with the lowest level in the year 2000. On the other hand it was 103% for the year 2001. The same was nearly equal for the average number of leaves blad which was 120% and 118% for the years 2000 and 2001, respectively. On the other side, the average leaf area was converted to be higher for the year 2001 (148%), where as it was 115% for the year 2000.

Data in table (3) represented the effect of four levels of split treatments, which were Phosphorein., Nitrobein . Potassein and Control (untreated). In general, phosphorien treatment gave significantly the lowest vegetative growth tested traits during the two successive seasons compared

with organic manure nitrobein and potassein, followed by the untreated treatment. This could lead to increase the
available phosphorus in soil (sequentially it was not need to phosphorein which contains active becteria capable to convert tri-calcium phosphate to available -P(Mono-P). The best treatment was that of potassein for plant height and average number of leaf blades, where as nitrobein treatment gave the highest leaf area.

Related Data reveled that nitrobein had positive effect on average number of leaf blades during the first season and average leaf area during the two growing seasons compared with organic manure and phosphorein. The beneficial effect of the bio-fertilizer on vegetative growth may be related to the enhancing effects on non-symbiotic N_2-Fixing bacteria on morphology and/or physiology of the root system, which probably promoted the vegetative growth to go forward. Jagnow *et al.* (1991) and Noel *et al.* (1996), indicated that non-symbiotic N_2-Fixing bacteria; Azotobacter and Azospirillm strains produced adequate amounts of IAA and Cytokinins and enhance root hair branching with an increase in the uptake of nutrients from the soil.

Effect of potassein, Data in Table 3, revealed that potassein surpassed the effects of the tested treatments, organic manure (FYM), phosphorein and nitrobein during the two seasons.

The interaction between organic fertilizer, potassein, nitrobein and phosphorein: Organic manure levels indicated that the highest rate ($120m^3$/Fed) exerted its increasing effect on the plant height during two seasons. No significant between potassein and nitrobein was detected on average number of leaves blad and average leaf area. The results reported by Frommel *et al.*(1993), El-Gamal, (1996). and Ashour *et al.* (1997) confirmed our findings concerning the stimulating effect of bio-fertilizers on potato vegetative growth characters. Interaction between FYM levels and bio-fertilizer as presented in table (3), showed that the best interaction was that of the highest level of FYM i.e. ($120m^3$/Fed) with potassein treatment for all vegetative growth studied traits, which confirmed the above results.

II- Yield and yield components

Data presented in table (4) showed the influence of organic manure levels, bio-fertilizers and potassein on yield and yield components i.e. during 2000 and 2001 seasons. Corms fresh weight/plant, total yield/Fed, number of cormels/plant, average corm length (cm), and diameter (cm) and dry weight % were also influenced.

Organic manure application showed significant differences between the applied levels. Data of the year 2000 were generally less than the year 2001. This could be due to the environmental conditions i.e. weather, temperature, and soil location and fertility. But comparing with seasonal data in a percentage ratio revealed more or less similarity between the two seasons.

Applying $120m^3$/Fed. lead to a significant increase in the percentage of corms fresh weight/hill or plant of between 45 and 49%, which represent 15 and 20 Ton/Fed. Whereas, applying $80m^3$/Fed gave 39 and 28% significant increase more than the applied of $40m^3$/Fed.

Table (4) : Influence of organic manure, (FYM) level potassein and bio-fertilizer onTaro yield and yield components during 2000 and 2001 seasons .

Season		2000					2001				
FYM level m^3	1	2	3	4	Mean	1	2	3	4	Mean
Corms fresh weight / Plant										
40	1.200	1.430	1.547	1.033	1.303	1.474	1.886	2.161	1.150	1 668
80	1.410	1.517	2.340	1.390	1.664	2.355	2.543	2.653	1.695	2.312
120	1.377	2.033	2.376	1.773	1.888	2.500	2.692	2.913	1.842	2.487
Mean	1.329	1.660	2.086	1.399	1.618	2.110	2.374	2.576	1.562	2.155
L.S.D 0.05	FYM			0.061				0 148		
	Bio + Potassein			0.089				0.144		
	FYM + Bio			0.0153				0.249		
Total yield / fed										
40	9.600	11.44	12.38	8.26	10.42	11.79	15.35	17.29	9.200	13.34
80	11.28	12.14	18.72	11.12	13.31	18.84	20.35	21.23	13.56	18.49
120	11.02	16.27	18.97	14.19	15.10	19.83	21.54	23.31	14.74	19.85
Mean	10.63	13.28	16.69	11.19	12.95	16.82	18.99	20.11	12.50	17.24
L.S.D 0.05	FYM			0.917				0.736		
	Bio + Potassein			0.917				0.714		
	FYM + Bio			1.589				1.236		
Number of cormels / plant										
40	3.190	3.110	1.183	1.943	2.35	5.277	5.590	3.945	5.473	5.071
80	2.997	2.923	1.687	1.813	2.355	7.373	6.400	5.723	6.147	6.411
120	3.460	2.523	1.930	2.213	2.532	7.560	7.110	5.240	6.233	6.536
Mean	3.216	2.852	1.600	1.990	2.415	6.737	6.367	4.969	5.951	6.006
L.S.D 0.05	FYM			0.226				0.270		
	Bio + Potassein			0.302				0.342		
	FYM + Bio			0.523				0.592		
Average corm length (cm)										
40	5.400	4.500	7.533	7.367	6.200	9.400	10.90	13.09	10.42	10.95
80	5.900	5.400	7.933	7.733	6.742	10.66	11.98	13.71	11.04	11.85
120	6.667	6.267	8.933	8.933	7.700	12.62	14.01	14.59	12.07	13.32
Mean	5.989	5.389	8.133	8.011	6.	10.90	12.30	13 80	11.17	12.04
L.S.D 0.05	FYM			0.239				0.569		
	Bio + Potassein			0.292				0.208		
	FYM + Bio			0.506				0.360		
Average corm diameter (cm)										
40	6.100	4.367	7.167	7.800	6.358	9.743	11.44	11.81	9.633	10.6
80	5.667	4.667	7.433	6.467	6.058	10.28	11.99	12.87	11.98	11.7
120	5.700	6.467	7.533	8.433	7.033	12.58	12.58	13.36	11.31	12.4
Mean	5.822	5.167	7.378	7.567	8.483	10.87	12.00	12.68	10.97	11.63
L.S.D 0.05	FYM			0.318				0.217		
	Bio + Potassein			0.527				0.368		
	FYM + Bio			0.913				0.637		

1) FYM + Phosphorein
2) FYM + Nitrobein
3) FYM+ Potasein
4) FYM (40,80,120 m^3 / Fed)

Number of cormels/plant hill didn't show any significant difference for the first season due to FYM applied levels. The second season data didn't show any significant differences between the two highest levels of FYM, i.e. 80 and 120m^3/Fed, but both rates gave significantly higher than the lowest level, 40m^3. Average length and diameter of corms data, showed a significant difference between the highest application of FYM, i.e. 120m^3/Fed and the other two lowest applications its increase percentages were 14 and 21% in the two seasons (2000 and 2001) respectively for average corm length, and 10 and 12% for the average corm diameter. Similar results were obtained by Sood *et al.* (1994) Kolbe *et al.* 1995; El-Nagar 1996; Sing *et al.*, 1996, and El-Kader 2002.

Data of two bio-fertilizers, i.e. phosphorein and Nitrobein, and potassein foliar spray, beside the untreated presented in table 4. indicated that the significant highest corms fresh weight/plant was that of potassein treatment, which were 2.086 and 2.576 kg for 2000 and 2001 seasons, respectively. Followed by nitrobein, which gave 1.660 and 2.374 kg for the two seasons. These results agreed with those obtained by Ashour *et al.*(1997) and Gomez and Munez (1998). phosphorein and control treatments, didn't show significant difference for the year 2000, whereas phesphorein was significantly higher than that of the untreated control treatment for the second season. Number of cormels/plant data in table (4) also show that phesphorein treatment in the two seasons gave significantly higher numbers, 3.2 and 6.7 cormels. Followed by nitrobein and potassein with a significant difference.The lowest number of cormels/plant was that of untreated plots. These results indicated that phosphorein tend to increase the numbers of cormels per plant.

Whereas the average length and diameter data were significantly larger with potassein treatment.

Data in table (4) showed that the highest level of applying FYM, i.e. 120m^3 increased significantly dry weight percentage in both seasons. The percentages of increment were 20.8 and 22.8%, for years 2000 and 2001, respectively

Potassein treatments were also of higher effect over the other treatment for the two studied seasons. These results are in agreement with El-Shal *et al.* 1993.

Interaction data supported those previous results, where the 120m^3 level of FYM plus potassein gave a significant higher dry weight percentage over the other interactions in the two seasons, except that interactions of 80m^3 FYM x potassein and 120m^3 FYM x nitrobein for the year 2000, and 80m^3 FYM x potassein and 120m^3 FYM x phosphorein for the second year 2001.

III- Chemical constituents :

Protein, starch and NPK contents in corms :-

Data in Fig (1,2) indicated that application of FYM resulted in significant increase of starch, protein and NPK in the tubers. Starch percentage of tuber 6.67, 13.72% with 80,40m^3 compared with 120m^3 protein content of tuber 12.42, 33.29% with 80,40m^3 compared with 120m^3 .

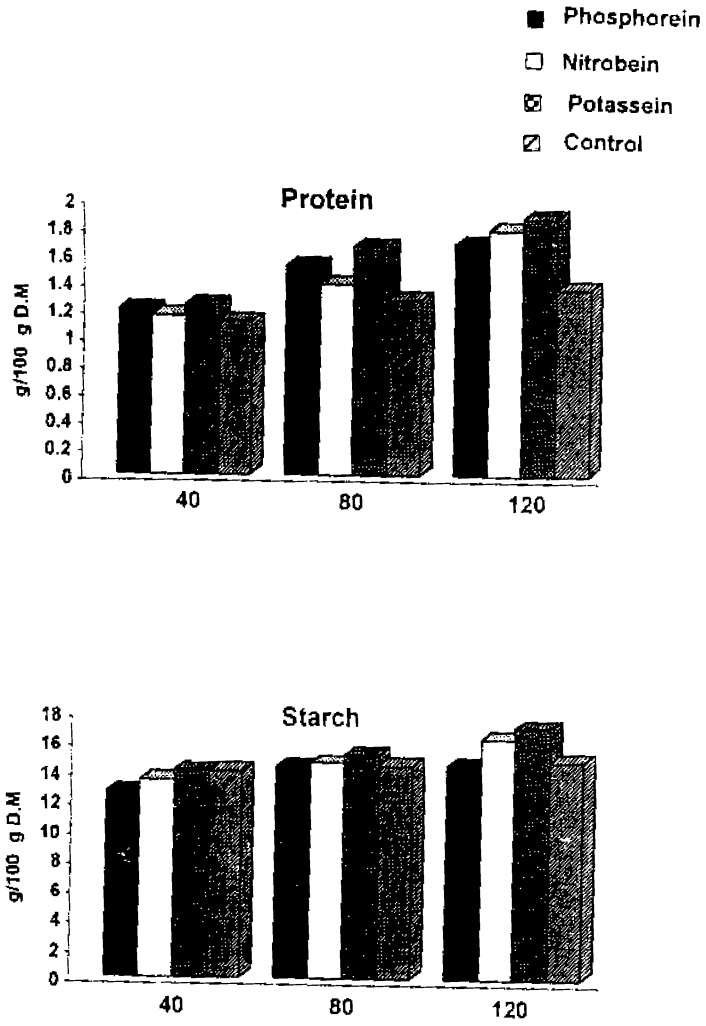

Fig.(1): Interactive effect of organic manure and Bio-Fertilizers (Phosphorein, Nitrobein and Potassein) on Protein and Starch concentration (g /100 g D.M) of **Taro** tubers at harvest time in the 2000 study.

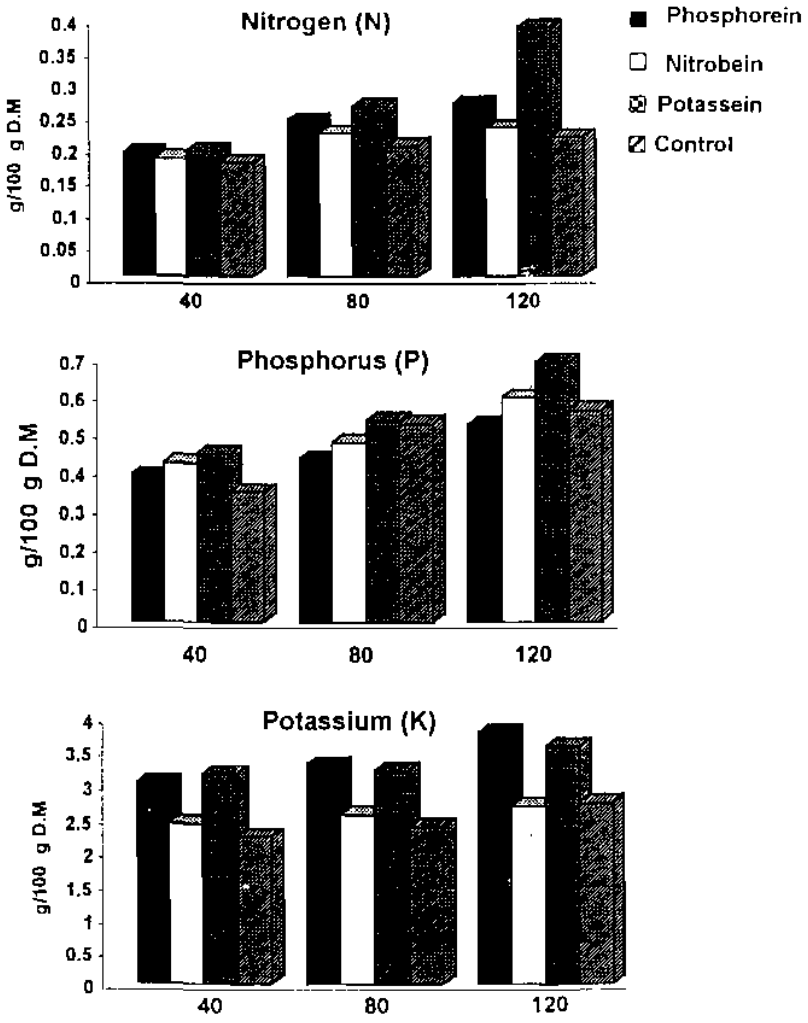

Fig.(2): Interactive effect of organic manure and Bio-Fertilizers (Phosphorein, Nitrobein and Potassein) on Nitrogen(N), Phosphorus (P) and Potassium (K) concentration (g /100 g D.M) of Taro tubers at harvest time in the 2000 study.

This may be attributed to the effect of FYM as a source of essential nutrients beside improving the physical and chemical properties of the soil. Similar results were obtained by Sarma *et al* (1995) and Escalada and Ratilla (1998). Also, Data in Fig (1,2) show that protein, starch and NPK in tubers were significantly increased with potassein compared with phosphorein while, the higher percentage of protein and starch no significant effect between potassein and nitrobein. Also, no significant effects of nitrogen percentage with potassein and phosphorein while, applying nitrobein gave higher percentage with phosphorus and phosphorein with potassium percentage.

CONCLUSION

It was obvious from the previous data that the best range of FYM was between 80 and 120m^3. The total yield data didn't show any significant difference between both levels by potassien foliar spray for the first season in year 2000. On the other hand, the same two levels in the second season, 2001 showed a significant differences. Where the FYM level of 120m^3 gave a significant higher total yield by potassein foliar spray the increase in total yield was 2.08 tons/Fed., which didn't worth economically raising the FYM by 40m^3 from 80m^3 to 120m^3. Therefore, it could be recommended using the FYM at a level of 80m^3 followed by potassein foliar spray. In the mean time, recommendation of more studies should be made with raising the levels of phosphorein and nitrobein.

REFERENCES

Almeid, D.L.; G. G. Pessanha; H.O. Vasconcelos and R.C. Salek (1984). Effects of spacing and organic manure in yam *Colocasia esculent* L. Schott) production. EMBRAPA, Empresa de pesquisa Agropecuaria de Es Tada de Rio de, 23.460 seroped,cd, RJ, Brazil.

Arisha, H.M. and A. Bardisi (1999). Effect of mineral and organic fertilizer on growth, yield and quality of potato under sandy soil conditions. Zagazig J. Agric. Res., 20(2) :391-405.

Ashour, S.A.; A.E. Abd El-Fattah and A.A. Tawfik (1997). Effect of nitrbein (bio-fertilizer) and different levels of nitrogen on growth and yield of potato (*Solanum tuberosum* L.) J.Agric Sic. Mansoura Univ.,22 (11): 3979-3986.

Balba, A.(1973). Organic and inorganic Fertilization of sandy soils. FAO soils Bull. No. 21 sandy soils 23-46, Rome (1975)

Borin, M. ; C. Giupponi and F. Osele (1987). The effect of organic and mineral Fertilizer and soil type on potato tuber Formation. Information. *Agrario*, 43:91.

Browaldh, M. (1992). Influence of organic and inorganic fertilizers on common bean (*Phaseolus vulgaris* L.) grown in a P-Fixing Mollic Andosol. Biol. Agric. and Hort., 9:87.

Brown, J. and O. Lilliland (1946). Rapid determination of potassium are sodium in plant material and soil extracts by Flame photometr proc,

Amer. Soc. Hort. Sci., 48: 341-346.

Brown, M.E.; Burlingham and R.M. Jackson (1964). Studies on A30 to bucter species in soil. III-Effects of artificial inoculation on crop yields. Plant and Soil, 20(21):194-214.

Carletti, S.; C.E. Rodriguez and B. Liorente (1996). Effect of bio-fertilizer application on Jojoba Cultivation. Association for the Advances Industrial crops. 1996: 53-55. (C.F. Hort. Abst., 1997-67 (2): 1599.

Cooke, G.W. (1982). Fertilizing for Maximum yield 3rd Ed-Collins professional and Techical Books, 465 pp.

El-Gamal, A.M. (1996). Response of potato in the newly reclaimed areas to mineral nitrogen fertilizer levels and nitrogen fixing bio-fertilizer Halex 2. Assiut J. Agric. Sci., 27 (2): 89-99.

El-Haddad M.E.; Y.Z. Ischac and M.I. Mostafa (1993). The role of bio-fertilizer in reducing agricultural costs, decreasing environmental pollution and raising crop yields. Arab Univ.J. Agric.Sci.Ain Shams Univ.,(1).147-159.

El-Kader, A.E. (2002). Effect of some Organic and mineral fertilizers On some potato cultivars. M.Sc. Thesis, Fac. of Agric., Mansoura Univ., Egypt.
El-Nagar, E.M. (1996). Effect of applying some organic residues to sandy and calcareous soils on growth and composition of some plants. M.Sc. Thesis, Fac. of Agric., Mansoura Univ., Egypt.

El-Shal, M.A.;F.I.El-Adgham; S.M.El- Araby and M.A.S. Barakat (1993). Studies on the effects of potassium fertilization and gibberellic acid on vegetative growth and head yield of globe artichoke under northern coastal region conditions. Minia 1st conference for Hort. Crop (Oct.21,1993) Minia J.Agric. Res. Develop., 15:1993.

Escalada,RG. and B.C. Ratilla (1998). Effects of leucaena biomass application in conjunction with fertilizers on cassava and taro yields in the Philippines. Agroforestry – systems. 1998,41(3): 251-266.

Fisher, A. and C. Richter (1984). Influence of organic and min fertilizers on yield and quality of potatoes. The Fifth IFO International scientific conference at the University of Ka Germany.p.37.

Frommel, M.L.; J. Nowak and G. Lazarovits (1993). Treatment of potato tubers with a growth promoting Pseudomonas Sp: plant growth responses and bacterium distribution in the rhizosphere. Plant and Soil, 150:51-60.

Gomez, R. and H.A. Munoz. (1998). Bio-fertilization of garlic "Allium sativum, L." on a compacted red ferralitic soil. Cultivos Tropicales, 19 (2): 9-13. (C.F.) Hort.Abst. 69, 7739.

Jagnow, G.; G. Holifch and K.H. Hoff Mann (1991). Inoculation of nonsymbiotic rhizosphere bacteria: possibilities of increasing and stabilizing yields. Angew. Botanik, 65.97-126.

Koch, F.G. and T.L. Mc Meckin (1924). A new direct nasalization micro. Keldahl method and ammonium. J.Am. Soc. Chem., 46:521.

Kolbe, H;S. Meineke and W.L. Zhang (1995). Differences in Organic and mineral Fertilization on potato tuber yield and chemical composition compared to model calculations. Agribiol. Res., 48(1): 63-73.

Marishita, M. (1988). Taro *(colocasia escubuta* L. Schott). In: Biotechnology in Agriculture and faresty 6, crop II, PP. 322-337. Edited by y.p.s. Baja. Springier verlog, Berlin.

Mervat, A.T. Amara and M.S.A.Dahdoh (1995). Effect of inoculation with plant growth promoting rhizo bacteria (PGPR) on yield and uptake of nutrients by wheat grown on sandy soil. Fifth National congress on Bio Agriclture Relation to Environment., Nov.-20-21, 1995 Cairo, Egypt.

Nelson, N.(1974). A photometry adaptation of the Somogyi methods for determination of glucose.J. Biology, Chem., 195:19-23.

Noel, T.C; C. Sheng; C.K. Yost; R.P. Pharis and M.E. Hynes (1996).Rhizobium legumins oarum as a plant growth – promoting rhizobacterium : direct growth promotion of canola and Lettuce. Can.J.of Microbial., 42(3): 279-283.

Parr,J.F. (1975). Chemical and Biological con siderations for land application of agricultural and municipal wastes. FAO. Soils. Bull No 27 "Organic material as fertilizer" 227-752.

Pregl, F. (1945). Quantitative organic micro analysis. Fourth Edition, Churchill, London. Purea-M;Mataora-T; Craswell-ET(Ed.); Asher- Cj (Ed.), O-sullivan-JN. 1996 Mineral nutrition of root crops in cook Islands. Min of Agric, po Box 96, Rarotonga, cook Is lands.

Sahota,T.S. (1983). Direct and residual effects of FYM, P and K on potato at Shillong. Bengladesh Hort., 11(2): 34-37.

Salem, N.M.M. (1986). Agro-Chemical aspects related to the use of conditions and organic wastes in soils. Ph. D. Thesis, Fac. Agric Sci., Rijksuniv Gent. Belgium.

Sarma,N.N.; J.K. Dey; D. Sarma; D.D. Singha; Borap; R. Sarma (1995). Improved practica in place of shifting cultivation and its effect on soil properties at Diphu in Assam. Indian-Jor-of-Agr-Sci-1995, 65(3): 196-201,. 8 Ref.

SAS Institute, I (1989). SAS/STAT User's Guide-Version 6, 4th Ed. Cary, N. Caroling : SAS. Institute, Inc. pp. 846. IsB: 1-5554y-376-1.

Sing S.P.; V. Singh; L. Ram; U.Sing and R. Lakham (1996). Effect of phosphorus and farmyard manure application on yield, content and uptake of nitrogen, phosphorus and sulfur by potato (*Solanum tuberosum* L.). Indian J. Agron., 41(4): 630-632.

Sood, M.; G. Shekhawat; S. Shurana; S. Pandey and U.Chandla (1994). Effect of tilage and mode of farmyard manure application on potato growth and yield. Potato: present & Future Proceedings of the National Symposium held at Modipuram during March, 1-3 PP. 121-123.

Somogyi, M. (1952).Notes on sugars determination. J. Biology Chem., 19-23- 195.

Tisdale, S.L; W.L. Nelson and I.U. Beaton (1985). Soil fertility and Fertilizers 4th Ed. Macmillan publishing Company. A division of Macmillan, Inc. New york. 45y-pp.

Troug, E. and Meyer (1939). Improvement in denies calorimetric method for phosphors and arsenic. Indian English Chemistry Analysis Edition, 1:136-139.

Wallace, A. (1994). Ten reasons why organic growers do not synthetically compoounded fertilizers. Commun. Soil Sci. plant Anal. 25(1x2) 125.Wilson, J.E. (1984). Cocoyam. In: Goldsworthy, P.R. and Fisner, N.m. (Eds), The physiology of Tropical Field Crops. John Wiley and Sons Ltd. P. 589-605.

تأثير الأسمدة العضوية والحيوية والرش بالبوتاسين على جودة ومحصول القلقاس

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يعتبر القلقاس من نباتات الفلقة الواحدة التابعة للعائلة الأرسية . ويعتبر من محاصيل الخضر الهامة فى مصر لقيمته الغذائية الاقتصادية العالية . أجريت هذه الدراسة بمحطة بحوث البساتين بالقناطر الخيرية للتعرف على تأثير المستويات المختلفة من الأسمدة البلدية (٤٠ ، ٨٠ ، ١٢٠م^{٣}/فدان) على القلقاس المحلى (بلدى) بجانب الأسمدة الحيوية (نتروبين ، فسفورين) والسماد الورقى بوتاسين . فى عامى ٢٠٠٠ ، ٢٠٠١ على نمو النباتات والمحصول ومكوناته بجانب التركيب الكيماوى للكورمات. وعموما فقد دلت جميع الصفات تحت الدراسة أن أفضل النباتات كانت تلك المعاملة بالمستويات المختلفة من الأسمدة البلدية . فبزيادة معدلات الأسمدة البلدية من ٤٠ إلى ١٢٠م^{٣}/فدان أدت إلى زيادة معنوية فى جميع القياسات وهذا بجانب أن أفضل النتائج كانت عند إستخدام البوتاسين رشا على الأوراق مقارنة بكل من النتروبين والفسفورين . وكانت معاملة الأسمدة البلدية على مستوى ١٢٠م^{٣}/فدان مع الرش الورقى بمادة البوتاسين أدت إلى زيادة فى المحصول الكلى حتى وصلت إلى ١٨،٩٦ ، ٢٣،٣١طن/فدان فى عامى ٢٠٠٠ ، ٢٠٠١ على الترتيب . زاد الوزن الجاف عند المستوى العالى فى الأسمدة البلدية (١٢٠م^{٣}/فدان) والرش الورقى بالبوتاسين . وقد وجد أن المستوى العالى من الأسمدة البلدية (١٢٠م^{٣}/فدان) مع النتروبين وأن المستوى المتوسط من الأسمدة البلدية (٨٠م^{٣}/فدان) مع الرش الورقى بالبوتاسين كانت أفضل معدلات للحصول على أعلا وزن جاف للكورمات. وقد دلت النتائج أيضا أن إستخدام الأسمدة البلدية أو رش الأوراق بالبوتاسين أدت كل منهما إلى زيادة معنوية فى كل من النشا والبروتين والنتروجين والفسفور والبوتاسيوم فى الكورمات ولم يعطى معاملتى البوتاسين والنتروبين أى فروق معنوية بين النسب المئوية لكل من البروتين والنشا . ولقد أدى إستخدام النتروبين إلى أعلا نسبة مئوية فى الفسفور والفسفورين إلى أعلا نسبة مئوية للبوتاسيوم .