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RESPONSE OF COW PEA TO APPLICATION OF K AND FARMYARD MANURE UNDER NEW VALLEY CONDITIONS

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ABSTRACT

Two field experiments were conducted at the New Valley Agriculture Research Station, ARC, during the two successive seasons; 2006 and 2007 to study the effect of varying rates and timing of K and farmyard manure (FYM) applications on forage yield and quality of cow pea local cultivar. The experimental design was arranged in split- split plot with three replications. The study included two time of K application (during and after 21 days from sowing), four K fertilizer rates (0, 50,100, and 150 kg K_2O /fad.) in the form of potassium sulphate and four FYM rates (0, 10, 20 and 30 m^3/fad.). Results indicated significant differences between treatments. The results showed that application of 150 kg K_2O/fad. with 30 m^3 FYM mixture when K was adding during sowing caused significant increases in the total fresh and dry forage yields as compared with application of 150 kg K_2O/fad. with 30 m^3 FYM mixture when K was adding after 21 days from sowing. These increases amounted 37.40, 36.38 and 39.35, 33.08 %, respectively. Meanwhile the same treatment caused significant increases in the total crude protein yield, K, P and Ca uptake. These increases amounted 51.56, 46.47, 80.40 and 39.07 %, respectively.

Keywords: Cow pea, Potassium fertilizer, Organic fertilizer, Yield and Chemical composition.

INTRODUCTION

The demand for summer forage crops of good quality for livestock has increased vigorously in recent years. In Egypt, farmers often use cow pea for seed and for animal feeding after harvesting the pods. Cow pea usually planted either in pure stand or in mixture with maize, sorghum and pearl millet in Upper Egypt and other reclaimed areas to meet the demand of livestocks in summer season. It is necessary to increase forage yield per faddan of cow pea by improving the cultural practices. In this respect, cow pea is one of the promising summer annual legume forage crop. It is will adapt to a wide range of ecological conditions and can produce better forage yield under unfavorable conditions in the newly reclaimed sandy and calcareous soils. Such soil may adversely affect the availability of some mineral nutrients to the grown crops.

Under Egyptian conditions, K fertilization is gaining progressive consideration particularly after the construction of High Dam in 1964. Non-exchangeable K is the source for more than 82% of the K – uptake in the alluvial soils and no more than 58% in the highly calcareous soil; and the highly calcareous soils contain less exchangeable – K than the alluvial soils (Sabit *et al.,* 1976).

Mengel (1978) mentioned that under arid and semi- arid conditions, intensive cropping, depleted soil K; and application of K was necessary to maintain acceptable yield.

Response of crops to applied fertilizers depends on soil organic matter. The quantity of organic material which can be introduced into the soil either by natural returns through roots, stubbles, sloughed- off root, nodules and root exudates or by artificial application in the form of organic manure which can otherwise be called organic fertilizer(Agboola and Omueti,1982). Nutrients contained in organic manure are released more slowly and are stored for a longer time in the soil, thereby ensuring a long residual effect (Sharma and Mittra, 1991). Improvement of environmental conditions and public health as well as the need to reduce costs of fertilizing crops are also important reasons for advocating increased use of organic materials (Seifritz, 1982).Complementary use of organic manure and mineral fertilizers has been proved to be a sound soil fertility management strategy in many countries of the world (Lombin *et al*., 1991). High and sustained crop yield could be obtained with judicious and balanced NPK fertilization combined with organic matter amendments (Bayu *et al*., 2006)

Therefore, the main objective of this investigation was to quantify the effect of varying rates and timing of K and organic fertilizer applications on forage yield and quality of cow pea under conditions of sandy soil of New Valley.

MATERIALS AND METHODS

This investigation was conducted at the New Valley Agricultural Experimental Station, ARC, during 2006 and 2007 summer seasons. The study aimed to investigate the effect of various levels and time of K and farmyard manure application on growth and forage yield as well as chemical composition of cow pea (*Vigna sinesis, L*.). The soil of the Experimental Station was sandy and its properties as well as farmyard manure properties are listed in Table (1).

Table (1): Initial physical and chemical analysis of both soil and farmyard manure before conducting the experiment (average of the two seasons).

Soil				Farmyard manure	
Physical		Chemical			
Texture	Sandy	**$CaCo_3$ %**	0.80	**Total N %**	1.5
Sand %	87.10	**pH(1:2.5) suspension**	7.60	**Organic matter %**	38.5
		EC(1:5) extract dS/m	0.19	**Organic carbon %**	20.93
Silt %	5.57	**Total N %**	0.016	**C/N ratio**	21.46
		Available P ppm	3.48	**pH**	6.80
		Ca^{+2} meq/100 g soil	0.28		
		Mg^{+2} " "	0.27		
Clay %	7.33	**Na^{+} " "**	0.34	**Available N ppm**	980
		K^{+} " "	0.09		
		Cl^{-} " "	0.19	**Available K ppm**	808
		So_4^{-2} " "	0.29		

Every experiment included thirty two treatments which were the combination of two dates of adding K fertilizer and four levels each of farmyard manure (FYM) and K fertilization. A split-split plot design with three replications was used. The main plots were assigned for the two dates of adding K fertilizer (during sowing and after twenty one day of sowing). The sub-plots were assigned to K fertilizer levels (zero, 50,100 and 150 kg K_2O/ fad.).The four farmyard manure (FYM) levels (0, 10, 20 and 30 m^3/fad.) were assigned to the sub-sub-plots. The sub-sub plot area was 6 m^2 (2X3 m) having 5 rows of 3m length and 40 cm width. Cow pea cultivar was local. Seeding was carried out by drilling on May 29th and June 6th in 2006 and 2007 seasons, respectively at a rate of 30 kg/fad. Cow pea seeds were inoculated with the specific strain of nodule bacteria before planting. The plants were thinned at two plants per hill, 20 cm apart, after 21 day from planting. The preceding crop was wheat in the first season and garlic in the second season. Calcium super phosphate (15.5% P_2O_5), Potassium sulphate (48% K_2O) and farmyard manure (in the form of sugar cane byproducts) were added after plots preparation and before sowing. Nitrogen (50kg/fad.) was added as Ammonium nitrate (33.5% N) before the 2nd irrigation. The normal cultural practices were used. The first cut was taken after 60 days from planting and the second and third cuts were taken after 45 and 85 days from the first cut in both seasons, respectively.

Traits studied in each cut were as follow:

A: Yield traits:

1- Fresh forage yield (t/fad.): All plants of each plot were hand clipped and weighed in kg/plot, then transferred to t/fad.

2- Dry forage yield (t/fad.): Sub samples of 100 gm each were dried at 105^{o}C to constant weight and dry matter percentage was estimated. The dry forage yield (t/fad.) was calculated by multiplying fresh forage (t/fad.) with dry matter percentage (DM %)

B: Chemical composition

Chemical analysis followed the conventional method recommended by the Association of Official Agricultural Chemists A.O.A.C. (1980) on the dried samples at 70^{o}C for each cut of the first season to determine crude protein (CP %). Calcium (Ca %) content was determined by using atomic absorption spectrophotometer apparatus (Perkins Elmer, Model 372), Phosphorus (P %) content was measured calorimetrically by using Spectrophotometer (Spectronic 21-D) and Potassium (K %) was measured by Flame photometer according to Soltanpour (1985).

Protein yield (kg/fad.), K uptake, P uptake and Ca uptake (kg/fad.) were calculated by multiplying dry matter yield (kg/fad.) by crude protein, K, P, and Ca percentages.

Data were statistically analyzed according to procedure outlined by Snedecor and Cochran (1980) using MSTST-C Computer program V.4 (1986).

RESULTS AND DISSCUSION

1- Forage yield.

1-2- Fresh and dry forage yields.

The response of forage cow pea to time of K application, levels of K and FYM and their interactions are presented in Tables (2, 3, 4 and 5). The levels of any investigated factor do not behave the same under the levels of other factors. The significant effects of the interaction between these factors on the accumulated fresh and dry forage yields will be discussed. Significant differences were noticed in the accumulated fresh and dry forage yields in the two successive seasons. It is clear from the data presented in Table (2) that adding K before sowing surpassed that of adding K after 21 days from sowing in the accumulated fresh and dry forage yields. The increases in the accumulated fresh and dry forage yields amounted 35.28, 36.98 and 37.15, 3199 % in the first and second seasons, respectively. With regard to K levels, results revealed that the application of 150 kg K/ fad. significantly increased the accumulated fresh and dry forage yields. These increases amounted 45.80, 45.62 and 40.07, 42.90 % as compared with the control in the first and second seasons, respectively. Concerning the levels of FYM, application of 30 m^3/fad. significantly increased the accumulated fresh and dry forage yields. These increases amounted 45.70, 38.03 and 37.30, 35.14 % as compared with the control in the first and second seasons, respectively.

Results of the accumulated fresh and dry forage yields as affected by the interactions between time of K application and K levels; and between time of K application and FYM levels are presented in Table (3). Results indicated significant differences in the accumulated fresh and dry forage yields of the two successive seasons. It is clear from the data that the increases in the accumulated fresh and dry forage yields with increasing the levels of K was greatly higher when K was applied during sowing if compared with that of adding K after 21 days from sowing. The increase in the accumulated fresh and dry forage yields by application of 150 kg K/fad. when adding K during sowing amounted 40.71, 43.83 and 41.98, 34.84 % as compared of application of 150 kg K / fad. when K adding after 21 days from sowing in the first and second seasons, respectively. While there was no significant effect between the control treatment and the treatment of application 50 kg K/fad. when K was added after 21 day from sowing.

Increased dry matter yield caused by application of high K were reported by other researchers (Shehata *et al*., 1989) in Faba bean and Mosaad and Abd El- Salaam (1992) in Soybean.

Similar trends were noticed with time of K application and levels of FYM. The increases in accumulated fresh and dry forage yields with increasing the levels of FYM was greatly higher when K was applied during sowing if compared with that of adding K after 21 days from sowing. The increases due to the application of 30 m^3 FYM/fad. when K was added during sowing amounted 32.44, 34.71 and 36.12, 33.23 % as compared with the application of 30 m^3 FYM/fad. when K was added after 21 days from sowing in the first and second seasons, respectively.

Results of the accumulated fresh and dry forage yields as affected by the interaction between K and FYM levels are presented in Table(4). The statistical analysis indicated significant differences among the different treatments in the two successive seasons. It is clear from the data that the increases in both accumulated fresh and dry forage yields due to the increases of FYM levels under zero level of K were significantly lower than those recorded with the higher levels of K application. The increases in the accumulated fresh and dry forage yields by the application of 30 m^3 FYM with 150 kg K/ fad. amounted 54.57, 45.49 and 42.22, 42.98 % as compared by the application 30 m3 FYM with zero level of K in the first and second seasons, respectively.

Results of the accumulated fresh and dry forage yields as affected by the interactions between time of adding K, levels of K and FYM application are presented in Table (5). It is clear from the data that the increases in both fresh and dry forage yields under higher levels of K and FYM when K was added during sowing were significantly higher than those recorded with higher levels of K and FYM when K was added after 21 days from sowing. The increases in accumulated fresh and dry forage yields due to the application 150 kg K with 30 m^3 FYM/ fad. when adding K during sowing amounted 37.40, 36.38 and 39.35, 33.08 % as compared by the application of 150 kg K with 30 m^3 FYM/fad. when adding K after 21 days from sowing in the first and second seasons, respectively.

This finding is in agreement with the finding of Kang and Balasubramanian (1990). They reported that high and sustained crop yields could be obtained with judicious and balanced NPK fertilization combined with organic matter amendments.

2- Chemical composition.

Results of the chemical composition (total protein yield, K uptake, P uptake and Ca uptake) in forage cow pea as affected by different levels of K, FYM and time of adding K fertilizer and their interactions are presented in Tables (6,7,8 and 9). The statistical analysis indicated significant differences in the total protein yield, K, P, and Ca uptake. It is clear from the data presented in Table (6) that adding K before sowing surpassed that of adding K after 21 days from sowing in total protein yield, K, P, and Ca uptake. The increases in the total protein yield, K, P, and Ca uptake amounted 56.1, 45.69, 36.66 and 39.17 %, respectively. With regard to K levels, results revealed that application of 150 kg K/ fad. significantly increased the total protein yield, K, P, and Ca uptake. These increases amounted 81.3, 73.68, 50.41 and 86.01 % as compared with the control, respectively. Concerning the levels of FYM, application of 30 m^3/ fad. significantly increased the total protein yield, K, P, and Ca uptake. These increases amounted 46.01, 79.73, 68.48 and 67.23 % as compared with the control, respectively.

Results of the total protein yield, K, P and Ca uptake as affected by the interactions between time of adding K and K levels ; and time of adding K and FYM levels are presented in Table (7).

The statistical analysis indicated significant differences in the total protein yield, K, P and Ca uptake. It is clear from the data that the increases in the total protein, K, P, and Ca uptake with increasing the levels of K was greatly higher when K was added during sowing if compared with that of adding after 21 days from sowing. The increases in the total protein yield, K, P and Ca uptake by application of 150 kg K/ fad. when K was added during sowing as compared with adding after 21 days from sowing amounted 54.61, 49.31, 76.57 and 32.23%, respectively.

Similar trend were noticed with time of adding K and levels of FYM. The increasing in total protein yield, K, P, and Ca uptake with increasing the levels of FYM was greatly higher when K was adding during sowing if compared with that adding before 21 days from sowing. The increases in total protein yield, K, P, and Ca uptake by application of 30 m^3 FYM/fad. when K was adding during sowing as compared with adding K after 21 days from sowing amounted 51.17, 40.57, 41.60 and 48.10 %, respectively.

Results of the total protein yield, K, P and Ca uptake as affected by the interaction between K and FYM levels are presented in Table (8). The statistical analysis indicated significant differences among the different treatments. It is clear from the data that the increases in the total protein yield, K, P and Ca uptake due to increases of FYM levels under zero level of K were significantly lower than those recorded with the higher levels of K application. The increases in the total protein yield, K, P and Ca uptake by the application of 30 m^3 FYM with 150 kg K/ fad. as compared by the application of 30 m^3 FYM with zero level of K amounted 73.80, 76.01, 50.32 and 90.65%, respectively.

Results of the total protein yield, K, P and Ca uptake as affected by the interactions between time of adding K , levels of K and FYM application are presented in Table (9). It is clear from the data that the increases in the total protein yield, K, P and Ca uptake under higher levels of K and FYM when K was added during sowing were significantly higher than those recorded with higher levels of K and FYM when adding K after 21 days from sowing. The increases in the total protein yield, K, P and Ca uptake by application of 150 kg K with 30 m^3 FYM/ fad. when adding K during sowing as compared by the application 150 kg K with 30 m^3 FYM/fad. when adding K after 21 days from sowing amounted 51.56, 46.74, 80.40 and 39.07%, respectively.

CONCLUSION

The highest cowpea yield and quality, realized from inorganic + organic fertilizer treatments, showed that cow pea benefited more from this combination than from other fertilizer treatments. This complementary application reduces the dependence of the farmer on inorganic fertilizer use. It also reduces the exposure of the soil to the consequences of inorganic fertilizer application.

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إستجابة لوبيا العلف للتسميد البوتاسي و العضوي تحت ظروف الوادي الجديد

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أقيمت تجربتان حقليتان بمحطة البحوث الزراعية بالوادي الجديد- مركز ألبحوث الزراعية خلال الموسمين الصيفيين (٢٠٠٦،٢٠٠٧) و ذلك لدراسة تأثير ميعاد و معدلات أضافة البوتاسيوم و كذلك السماد العضوي على حاصل ألعلف و نوعيته في لوبيا العلف صنف محلي.

أتبع تصميم القطع المنشقة مرتين في ثلاثة مكررات حيث وزعت مواعيد ألأضافة في القطع الرئيسية و معدلات أضافة البوتاسيوم في القطع الشقية الأولى و معدلات إضافة السماد العضوي في القطع الشقية الثانية.

أشتملت الدراسة على ميعادين لأضافة البوتاسيوم (عند ألزراعة و بعد ٢١ يوم من الزراعة) و أربعة معدلات أضافة (صفر، ٥٠ ،١٠٠ و١٥٠كجم بو٢أ / فدان) و أربعة معدلات من السماد العضوي (صفر، ١٠ ،٢٠ و٣٠ م^{٣}/ فدان).

أوضحت ألنتائج ألمتحصل عليها أن المعاملة (١٥٠كجم بوتاسيوم مخلوطة مع ٣٠ م^{٣} من السماد العضوي/ فدان عند أضافتها قبل الزراعة) تسببت في زيادة معنوية لحاصل العلف ألأخضر الكلي و حاصل العلف الجاف الكلي عنها في حالة أستخدام المعاملة (١٥٠كجم بوتا سيوم مخلوطة مع ٣٠ م^{٣} من لسماد العضوي/ فدان عند أضافتها بعد الزراعة) حيث كانت نسبة الزيادة ٣٧,٤٠ ،٣٦,٣٨ و٣٩,٣٥ ، ٣٣,٠٨ % في السنة ألأولى و ألثانية على ألتوالي.

و كذلك أعطت نفس المعاملة أعلى حاصل بروتين كلي وأعلى كمية من البوتاسيوم و الفوسفور والكالسيوم الممتص حيث كانت نسبة الزيادة ٥١,٥٦ ، ٤٦,٤٧ ، ٨٠,٤٠ و ٣٩,٠٧ % على التوالي.

Table (2): Effect of time of K application, levels of K and farmyard manure on fresh and dry forage yields of Cow pea in 2006and 2007 seasons.

Treat.		Fresh forage yield (t fad.$^{-1}$)								Dry forage yield (t fad.$^{-1}$)							
		2006				2007				2006				2007			
		Cut_1	Cut_2	Cut_3	Acc. yield	Cut_1	Cut_2	Cut_3	Acc. yield	Cut_1	Cut_2	Cut_3	Acc. yield	Cut_1	Cut_2	Cut_3	Acc. yield
A	A_1	13.65	10.37	6.27	30.29	12.13	9.61	6.04	27.78	3.36	2.59	1.58	7.53	3.23	2.71	1.94	7.88
	A_2	10.27	7.68	4.40	22.39	8.76	7.06	4.47	20.28	2.47	1.85	1.17	5.49	2.41	2.09	1.47	5.97
F- TEST		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
B	B_1	10.04	6.83	4.46	21.33	8.51	6.33	4.49	19.33	2.45	1.75	1.20	5.39	2.36	1.84	1.45	5.64
	B_2	11.55	8.53	4.99	25.07	10.33	7.79	5.09	23.21	2.80	2.19	1.26	6.24	2.86	2.25	1.66	6.77
	B_3	12.34	9.78	5.64	27.76	10.93	9.16	5.34	25.44	2.98	2.40	1.47	6.85	292	2.60	1.74	7.25
	B_4	13.91	10.96	6.23	31.10	12.01	10.05	6.09	28.15	3.44	2.55	1.56	7.55	3.15	2.92	1.99	8.06
LSD 0.05		**0.45**	**0.54**	**0.49**	**1.20**	**0.33**	**0.16**	**0.31**	**0.63**	**0.20**	**0.06**	**0.09**	**0.21**	**0.14**	**0.04**	**0.11**	**0.21**
C	C_1	10.04	7.28	4.33	21.66	8.98	6.90	4.41	20.30	2.55	1.85	1.15	5.55	2.42	2.03	1.45	5.89
	C_2	11.03	8.60	4.86	24.48	9.99	7.84	4.96	22.79	2.74	2.12	1.27	6.13	2.70	2.29	1.62	6.61
	C_3	12.47	9.45	5.64	27.56	10.82	8.66	5.53	25.02	3.01	2.30	1.44	6.75	2.97	2.48	1.80	7.25
	C_4	14.30	10.76	6.49	31.56	11.98	9.92	6.12	28.02	3.38	2.62	1.63	7.62	3.20	2.80	1.96	7.96
LSD 0.05		**0.45**	**0.35**	**0.40**	**0.81**	**0.33**	**0.27**	**0.15**	**0.47**	**0.16**	**0.06**	**0.09**	**0.19**	**0.10**	**0.01**	**0.06**	**0.15**

A= Time of K application (A_1 = during sowing, A_2 = after 21 day from sowing)
B = K_2O levels (B_1 = zero, B_2 = 50, B_3 =100 and B_4 = 150 (Kg/ fad.)
C = FYM levels (C_1 = zero, C_2 = 10, C_3 = 20 and C_4 = 30 (m^3/ fad.)
Acc. yield = Accumulated yield

Table (3): Effect of time and levels of K and time of K and levels of FYM applications on fresh and dry forage yields of Cow pea in 2006and 2007 seasons.

Treat.		Fresh forage yield (t fad.$^{-1}$)								Dry forage yield (t fad.$^{-1}$)							
		2006				2007				2006				2007			
		Cut_1	Cut_2	Cut_3	Accumulated yield	Cut_1	Cut_2	Cut_3	Accumulated yield	Cut_1	Cut_2	Cut_3	Accumulated yield	Cut_1	Cut_2	Cut_3	Accumulated yield
A_1	B_1	10.63	6.96	4.85	22.44	9.25	6.38	4.77	20.39	2.60	1.80	1.28	5.69	2.56	1.89	1.51	5.95
	B_2	13.39	10.24	5.91	29.53	12.39	9.34	5.88	27.61	3.24	2.67	1.44	7.35	3.41	2.66	1.87	7.94
	B_3	14.44	11.68	6.69	32.81	12.73	11.04	6.14	29.91	3.59	2.95	1.68	8.22	3.38	3.04	1.99	8.41
	B_4	16.14	12.60	7.61	36.36	14.16	11.68	7.38	33.21	4.01	2.95	1.90	8.86	3.57	3.26	2.41	9.25
A_2	B_1	9.45	6.69	4.07	20.21	7.76	6.28	4.22	18.26	2.28	1.70	1.11	5.09	2.15	1.78	1.39	5.32
	B_2	9.71	6.83	4.07	20.61	8.26	6.23	4.31	18.81	2.35	1.70	1.08	5.13	2.32	1.83	1.44	5.59
	B_3	10.24	7.88	4.59	22.71	9.14	7.28	4.54	20.96	2.39	1.86	1.25	5.48	2.46	2.15	1.48	6.09
	B_4	11.67	9.31	4.86	25.84	9.86	8.43	4.81	23.09	2.87	2.15	1.22	6.24	2.72	2.58	1.58	6.87
LSD 0.05		**0.64**	**0.78**	**0.70**	**1.70**	**0.49**	**0.38**	**0.21**	**0.67**	**0.29**	**0.09**	**0.13**	**0.29**	**0.15**	**0.10**	**0.09**	**0.21**
A_1	C_1	11.55	8.53	4.99	25.07	10.56	8.10	4.73	23.38	2.98	2.20	1.28	6.46	2.72	2.33	1.56	6.61
	C_2	12.73	9.71	5.64	28.09	11.78	8.78	5.64	26.19	3.21	2.43	1.46	7.10	3.12	2.49	1.84	7.44
	C_3	14.31	10.89	6.83	32.03	12.68	10.14	6.56	29.39	3.42	2.67	1.70	7.79	3.45	2.85	2.12	8.41
	C_4	16.02	12.34	7.61	35.96	13.51	11.41	7.24	32.17	3.84	3.07	1.87	8.78	3.63	3.19	2.27	9.10
A_2	C_1	8.53	6.04	3.68	18.24	7.41	5.70	4.09	17.21	2.13	1.49	1.02	4.63	2.10	1.73	1.35	5.18
	C_2	9.31	7.48	4.07	20.87	8.21	6.91	4.28	19.39	2.26	1.82	1.08	5.16	2.28	2.09	1.41	5.78
	C_3	10.63	8.01	4.46	23.10	8.96	7.18	4.51	20.65	2.59	1.94	1.19	5.70	2.49	2.11	1.48	6.08
	C_4	12.58	9.18	5.38	27.15	10.44	8.43	5.00	23.88	2.91	2.16	1.38	6.45	2.76	2.41	1.65	6.83
LSD 0.05		**0.65**	**0.49**	**0.57**	**1.15**	**0.49**	**0.38**	**0.21**	**0.67**	**0.22**	**0.10**	**0.13**	**0.27**	**0.15**	**0.10**	**0.09**	**0.21**

A= Time of K application (A_1 = during sowing, A_2 = after 21 day from sowing)
B = K_2O levels (B_1 = zero, B_2 = 50, B_3 =100 and B_4 = 150 (Kg/ fad.)
C = FYM levels (C_1 = zero, C_2 = 10, C_3 = 20 and C_4 = 30 (m^3/ fad.)

Table (4): Effect of levels of K and farmyard manure on fresh and dry forage yields of Cow pea in 2006 and 2007seasons.

Treat.		Fresh forage yield (t fad.$^{-1}$)								Dry forage yield (t fad.$^{-1}$)							
		2006				2007				2006				2007			
		Cut_1	Cut_2	Cut_3	Accumulated yield	Cut_1	Cut_2	Cut_3	Accumulated yield	Cut_1	Cut_2	Cut_3	Accumulated yield	Cut_1	Cut_2	Cut_3	Accumulated yield
B_1	C_1	7.61	5.51	4.20	17.33	6.40	5.28	4.06	15.73	1.86	1.44	1.12	4.42	1.83	1.57	1.31	4.70
	C_2	9.71	6.56	4.20	20.47	8.50	5.79	4.36	18.65	2.38	1.71	1.14	5.22	2.33	1.68	1.42	5.43
	C_3	10.50	7.35	4.73	22.58	8.41	6.81	4.78	20.00	2.47	1.87	1.28	5.61	2.39	1.96	1.53	5.87
	C_4	12.34	7.88	4.73	24.94	10.71	7.44	4.78	22.93	3.08	1.97	1.26	6.30	2.88	2.14	1.53	6.56
B_2	C_1	9.71	7.09	3.68	20.47	8.79	6.75	3.93	19.48	2.48	1.84	0.97	5.28	2.45	1.99	1.34	5.79
	C_2	9.98	8.14	4.73	22.84	9.35	7.14	4.89	21.38	2.46	2.09	1.21	5.75	2.59	2.06	1.59	6.24
	C_3	12.60	8.40	5.25	26.25	11.36	7.64	5.51	24.51	3.04	2.11	1.35	6.51	3.19	2.19	1.77	7.16
	C_4	13.91	10.50	6.30	30.71	11.81	9.63	6.04	27.48	3.22	2.71	1.51	7.44	3.22	2.74	1.92	7.88
B_3	C_1	10.76	8.14	4.73	23.63	9.75	7.88	4.66	22.29	2.72	2.04	1.28	6.04	2.59	2.24	1.52	6.34
	C_2	11.03	9.45	5.25	25.73	10.38	8.97	4.81	24.16	2.73	2.31	1.36	6.40	2.79	2.58	1.56	6.93
	C_3	13.13	10.50	6.04	29.66	11.51	9.51	5.95	26.98	3.14	2.55	1.52	7.21	3.07	2.68	1.94	7.69
	C_4	14.44	11.03	6.56	32.06	12.10	10.28	5.94	28.33	3.35	2.71	1.71	7.77	3.22	2.89	1.93	8.04
B_4	C_1	12.08	8.40	4.73	25.20	11.00	7.71	4.98	23.69	3.16	2.07	1.23	6.46	2.79	2.31	1.64	6.74
	C_2	13.39	10.24	5.25	38.88	11.73	9.47	5.76	26.98	3.39	2.38	1.37	7.14	3.09	2.84	1.91	7.85
	C_3	13.65	11.55	6.56	31.76	12.00	10.69	5.900	28.59	3.36	2.67	1.63	7.66	3.25	3.09	1.96	8.28
	C_4	16.51	13.64	8.40	38.55	13.29	12.34	7.74	33.36	3.86	3.08	2.02	8.96	3.47	3.43	2.47	9.38
LSD 0.05		**0.92**	**0.70**	**0.81**	**1.62**	**0.69**	**0.54**	**0.30**	**0.95**	**0.31**	**0.14**	**0.18**	**0.38**	**0.21**	**0.14**	**0.13**	**0.30**

B = K_2O levels (B_1 = zero, B_2 = 50, B_3 =100 and B_4 = 150 (Kg/ fad.)
C = FYM levels (C_1 = zero, C_2 = 10, C_3 = 20 and C_4 = 30 (m^3/ fad.)

Table (6): Effect of time of K application, levels of K and farmyard manure on protein yield, K, P and Ca uptake of Cow pea in 2006 season.

Treat.		Protein yield (Kg fad.$^{-1}$)				K uptake (Kg fad.$^{-1}$)				P uptake (Kg fad.$^{-1}$)				Ca uptake (Kg fad.$^{-1}$)			
		2006															
		Cut$_1$	Cut$_2$	Cut$_3$	Total	Cut$_1$	Cut$_2$	Cut$_3$	Total	Cut$_1$	Cut$_2$	Cut$_3$	Total	Cut$_1$	Cut$_2$	Cut$_3$	Total
A	A$_1$	860.49	634.97	372.76	1868.2	139.4	99.6	63.9	302.9	24.3	17.7	11.3	53.3	64.8	47.5	29.1	141.4
	A$_2$	550.98	404.67	241.89	1197.5	99.9	65.4	42.6	207.9	18.6	12.3	8.1	39.0	48.5	32.8	20.3	101.6
F- TEST		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
B	B$_1$	510.32	345.08	226.41	1081.8	90.8	56.7	40.6	188.1	17.5	11.1	7.9	36.5	41.4	26.8	18.3	86.5
	B$_2$	656.53	488.94	270.36	1415.8	107.2	77.0	47.2	231.4	20.0	14.5	8.9	43.4	50.0	37.1	21.7	108.8
	B$_3$	740.02	591.02	341.58	1672.6	126.5	91.5	57.6	275.6	22.7	16.7	10.5	49.9	59.6	43.8	26.6	130.0
	B$_4$	916.09	645.25	390.97	1961.3	154.2	104.8	67.7	326.7	25.7	17.7	11.5	54.9	75.7	52.8	32.4	160.9
LSD 0.05		**47.73**	**31.51**	**19.31**	**64.60**	**1.74**	**1.59**	**0.5**	**0.7**	**0.24**	**0.24**	**0.24**	**0.20**	**0.82**	**0.91**	**0.39**	**0.99**
C	C$_1$	594.14	433.01	248.15	1275.3	94.8	60.0	36.6	191.4	17.1	11.0	6.8	34.9	46.3	30.0	17.4	93.7
	C$_2$	634.95	481.38	278.50	1394.8	104.2	70.9	45.3	220.4	19.9	13.8	8.9	42.6	52.3	36.9	22.3	111.5
	C$_3$	737.65	536.15	325.73	1599.5	122.3	86.1	57.4	265.8	22.1	15.7	10.4	48.2	57.1	40.8	26.4	124.3
	C$_4$	856.21	628.75	376.93	1861.9	157.4	113.3	73.3	344.0	26.7	19.5	12.6	58.8	70.9	53.0	32.8	156.7
LSD 0.05		**47.73**	**31.51**	**19.31**	**64.60**	**1.74**	**1.59**	**0.5**	**0.7**	**0.24**	**0.24**	**0.24**	**0.20**	**0.82**	**0.91**	**0.39**	**0.99**

A= Time of K application (A$_1$ = during sowing, A$_2$ = after 21 day from sowing)
B = K$_2$O levels (B$_1$ = zero, B$_2$ = 50, B$_3$ =100 and B$_4$ = 150 (Kg/ fad.)
C = FYM levels (C$_1$ = zero, C$_2$ = 10, C$_3$ = 20 and C$_4$ = 30 (m^3/ fad.)

Table (7): Effect of time and levels of K applications and time of K and levels of FYM on protein yield, K, P and Ca uptake of Cow pea in 2006 season.

Treat.		Protein yield (Kg fad.$^{-1}$)				K uptake (Kg fad.$^{-1}$)				P uptake (Kg fad.$^{-1}$)				Ca uptake (Kg fad.$^{-1}$)			
		2006															
		Cut$_1$	Cut$_2$	Cut$_3$	Total	Cut$_1$	Cut$_2$	Cut$_3$	Total	Cut$_1$	Cut$_2$	Cut$_3$	Total	Cut$_1$	Cut$_2$	Cut$_3$	Total
A$_1$	B$_1$	610.3	377.2	257.3	1244.8	9.93	6.21	4.52	20.66	1.59	1.01	0.73	3.34	4.42	2.85	1.98	9.25
	B$_2$	800.1	619.6	327.9	1747.5	12.48	9.72	5.76	27.96	2.19	1.73	1.03	4.94	5.90	4.74	2.68	13.31
	B$_3$	925.4	762.7	410.3	2098.5	15.13	11.50	6.76	33.40	2.72	2.10	1.23	6.05	7.13	5.46	3.13	15.72
	B$_4$	1106.1	780.4	495.5	2382.1	18.19	12.42	8.53	39.15	3.24	2.24	1.53	7.01	8.49	5.95	3.90	18.34
A$_2$	B$_1$	410.3	313.0	195.5	918.8	8.24	5.14	3.60	16.99	1.91	1.22	0.85	3.99	3.88	2.51	1.68	8.07
	B$_2$	513.0	358.2	212.9	1084.1	8.95	5.69	3.68	18.32	1.82	1.17	0.76	3.75	4.11	2.69	1.66	8.45
	B$_3$	554.6	419.3	272.8	1246.7	10.17	6.81	4.77	21.74	1.84	1.25	0.87	3.96	4.80	3.32	2.20	10.32
	B$_4$	726.0	528.7	286.5	1540.6	12.64	8.55	5.03	26.22	1.90	1.30	0.76	3.97	6.66	4.62	2.59	13.87
LSD 0.05		**67.50**	**44.56**	**27.30**	**91.36**	**0.25**	**0.23**	**0.23**	**0.1**	**0.03**	**0.03**	**0.03**	**0.03**	**0.12**	**0.13**	**0.06**	**0.14**
A$_1$	C$_1$	728.9	551.6	294.0	1574.4	11.60	7.57	4.41	23.59	1.98	1.31	0.76	4.05	5.36	3.60	1.99	10.95
	C$_2$	806.7	573.7	337.7	1718.1	12.12	8.16	5.36	25.63	2.26	1.55	1.01	4.82	5.95	4.16	2.59	12.71
	C$_3$	888.0	649.1	404.1	1939.1	14.28	10.41	7.00	31.69	2.49	1.86	1.24	5.57	6.44	4.71	3.10	14.25
	C$_4$	1020.5	765.5	455.3	2241.2	17.75	13.71	8.80	40.26	30.1	2..38	1.52	6.91	8.19	6.53	4.00	18.72
A$_2$	C$_1$	459.4	314.5	202.3	976.2	7.36	4.42	2.92	14.71	1.45	0.95	0.60	2.95	3.91	2.40	1.51	7.82
	C$_2$	463.2	389.0	219.2	1071.5	8.71	6.03	3.71	18.45	1.74	1.22	0.76	3.72	4.52	3.22	1.89	9.63
	C$_3$	589.3	423.2	247.4	1259.9	10.19	6.80	4.49	21.47	1.94	1.30	0.86	4.11	5.00	3.45	2.17	12.64
	C$_4$	692.0	492.0	298.6	1482.5	13.73	8.95	5.95	28.64	2.35	1.52	1.02	4.88	6.01	4.07	2.59	12.64
LSD 0.05		**67.50**	**44.56**	**27.30**	**91.36**	**0.25**	**0.23**	**0.23**	**0.1**	**0.03**	**0.03**	**0.03**	**0.03**	**0.12**	**0.13**	**0.06**	**0.14**

A= Time of K application (A$_1$ = during sowing, A$_2$ = after 21 day from sowing)
B = K$_2$O levels (B$_1$ = zero, B$_2$ = 50, B$_3$ =100 and B$_4$ = 150 (Kg/ fad.)
C = FYM levels (C$_1$ = zero, C$_2$ = 10, C$_3$ = 20 and C$_4$ = 30 (m^3/ fad.)

Table (8): Effect of levels of K and farmyard manure on protein yield, K, P and Ca uptake of Cow pea in 2006 season.

Treat.		Protein yield (Kg fad.$^{-1}$)				K uptake (Kg fad.$^{-1}$)				P uptake (Kg fad.$^{-1}$)				Ca uptake (Kg fad.$^{-1}$)			
		2006															
		Cut_1	Cut_2	Cut_3	Total	Cut_1	Cut_2	Cut_3	Total	Cut_1	Cut_2	Cut_3	Total	Cut_1	Cut_2	Cut_3	Total
B_1	C_1	364.5	272.9	202.4	839.8	5.85	4.11	3.33	13.29	1.12	0.82	0.66	2.59	2.53	1.85	1.43	5.81
	C_2	417.1	327.6	209.7	954.4	8.31	5.02	3.77	17.10	1.68	1.05	0.78	3.50	3.91	2.46	1.75	8.12
	C_3	542.8	372.7	244.7	1160.2	9.32	6.01	4.24	19.56	1.85	1.21	0.84	3.89	4.49	2.99	2.01	9.49
	C_4	716.8	407.2	248.9	1372.8	12.88	7.57	4.90	25.35	2.37	1.40	0.90	4.67	5.67	3.44	2.13	11.23
B_2	C_1	545.8	399.0	199.4	1144.2	8.65	5.70	2.94	17.29	1.59	1.05	0.56	3.20	4.13	2.80	1.39	8.32
	C_2	566.3	448.9	253.9	1269.1	8.94	6.47	3.96	19.37	1.78	1.30	0.79	3.87	4.51	3.38	1.97	9.86
	C_3	725.2	477.0	293.5	1495.7	11.28	7.74	5.39	24.41	2.11	1.45	1.01	4.57	5.17	3.65	2.43	11.25
	C_4	788.8	630.9	334.6	1754.3	13.98	10.93	6.60	31.51	2.53	2.00	1.21	5.75	6.19	5.03	2.89	14.11
B_3	C_1	646.1	537.7	291.1	1474.9	10.61	7.00	4.00	21.61	1.93	1.28	0.73	3.94	5.26	3.54	1.93	10.72
	C_2	667.2	545.5	311.9	1524.6	10.51	7.95	4.87	23.33	2.06	1.58	0.97	4.60	5.41	4.22	2.46	12.09
	C_3	788.8	614.3	354.2	1757.1	13.27	9.62	6.13	29.02	2.40	1.78	1.13	5.32	6.15	4.35	2.80	13.29
	C_4	858.2	666.6	409.1	1933.9	16.20	12.06	8.07	36.33	2.72	2.06	1.37	6.16	7.06	5.46	3.46	15.98
B_4	C_1	820.1	522.4	299.8	1642.4	12.81	7.18	4.42	24.40	2.22	1.26	0.78	4.26	6.63	3.82	2.24	12.68
	C_2	889.1	603.6	338.5	1831.2	13.90	8.93	5.45	28.37	2.48	1.61	1.01	5.10	7.12	4.72	2.77	14.62
	C_3	894.1	680.7	410.5	1985.2	15.06	11.07	7.21	33.34	2.50	1.87	1.22	5.58	7.07	5.34	3.31	15.72
	C_4	1061.0	810.3	515.1	2386.2	19.89	14.77	9.95	44.62	3.09	2.34	1.59	7.02	9.48	7.27	4.66	21.41
LSD 0.05		**95.46**	**63.01**	**38.61**	**129.2**	**0.35**	**0.32**	**0.32**	**0.14**	**0.05**	**0.05**	**0.05**	**0.05**	**0.18**	**0.18**	**0.08**	**0.20**

A = Time of K application (A_1 = during sowing, A_2 = after 21 day from sowing)
B = K_2O levels (B_1 = zero, B_2 = 50, B_3 =100 and B_4 = 150 (Kg/ fad.)

Table (9): Effect of time of K application, levels of K and levels of FYM and their interactions on protein yield, K, P and Ca uptake of Cowpea in 2006 season.

Treatment			Protein yield (Kg/ fad.)				K uptake (Kg/ fad.)				P uptake (Kg/ fad.)				Ca uptake (Kg/ fad.)			
			2006															
			Cut_1	Cut_2	Cut_3	Total	Cut_1	Cut_2	Cut_3	Total	Cut_1	Cut_2	Cut_3	Total	Cut_1	Cut_2	Cut_3	Total
A_1	B_1	C_1	396.18	274.72	214.36	885.27	66.1	43.2	35.2	144.5	10.2	6.7	5.5	22.4	25.7	17.3	13.5	56.5
		C_2	600.47	357.98	240.92	1199.3	95.2	53.4	41.3	189.9	15.4	8.8	6.8	31	41.7	24.2	17.9	83.8
		C_3	627.11	404.90	279.85	1311.8	100.2	65.6	49.0	214.8	16.5	11.0	8.2	35.7	47.6	32.2	22.9	102.7
		C_4	817.42	471.16	294.17	1582.7	135.7	86.1	55.2	277	21.6	13.9	8.9	44.4	61.7	40.4	24.7	126.8
	B_2	C_1	712.90	540.41	234.30	1487.6	114.2	77.8	34.1	226.1	18.8	12.9	5.6	37.3	52.4	36.8	15.3	104.5
		C_2	720.49	555.84	312.97	1589.3	103.9	78.3	50.4	232.6	19.3	14.7	9.5	43.5	53.4	41.7	25.5	120.6
		C_3	844.83	585.64	362.16	1792.6	126.2	96.0	68.2	290.4	22.1	17.0	12.0	51.1	57.7	45.3	30.7	133.7
		C_4	922.11	746.54	401.98	2120.6	154.9	136.8	77.5	369.2	27.2	24.5	13.8	65.5	72.2	65.7	35.5	173.4
	B_3	C_1	806.02	737.23	355.02	1898.2	128.0	92.9	52.6	273.5	22.2	16.2	9.2	47.6	59.9	44.8	24.2	128.9
		C_2	852.13	667.51	367.05	1886.6	126.0	93.9	52.2	272.1	24.3	18.4	10.2	52.9	64.8	49.8	26.4	141
		C_3	1004.7	782.85	435.55	2223.1	165.2	119.5	71.9	356.6	29.9	22.2	13.3	65.4	75.3	512	32.2	619.5
		C_4	1038.8	863.33	483.74	2385.9	186.0	153.7	93.7	433.4	32.3	27.1	16.5	75.9	85.1	72.5	42.1	199.7
	B_4	C_1	1000.4	653.89	372.21	2026.5	155.6	89.0	54.6	299.2	28.1	16.3	1.00	45.4	76.3	45.0	26.3	147.6
		C_2	1053.6	713.57	429.97	2197.1	159.6	100.6	70.2	330.4	31.1	19.9	13.9	64.9	78.1	50.8	33.8	162.7
		C_3	1067.1	823.09	538.66	2428.8	179.3	135.4	90.7	405.4	30.9	23.7	15.8	70.4	76.6	59.7	38.1	174.4
		C_4	1303.4	930.92	641.30	2875.6	233.1	171.8	125.7	530.6	39.2	29.5	21.5	90.2	108.4	82.5	58.6	249.5
A_2	B_1	C_1	332.90	271.01	190.36	794.27	50.8	39.0	31.3	121.1	12.1	9.6	7.6	29.3	24.9	19.7	15.0	59.6
		C_2	233.81	297.24	178.46	709.51	71.0	47.0	34.1	152.1	18.0	12.1	8.8	38.9	36.4	24.9	17.2	78.5
		C_3	458.53	340.48	209.52	1008.5	8.61	54.4	35.7	98.71	20.4	13.1	8.6	42.1	42.2	27.5	17.3	87
		C_4	616.14	343.17	203.61	1162.9	121.8	65.1	42.8	229.7	25.7	14.0	9.1	48.8	51.5	28.4	17.8	97.7
	B_2	C_1	378.70	257.61	164.46	800.77	58.8	36.2	24.6	119.6	13.0	8.1	5.5	26.6	30.1	19.2	12.5	61.8
		C_2	412.15	341.92	194.83	948.91	74.9	51.0	28.7	154.6	16.2	11.2	6.3	33.7	3.67	25.8	13.9	43.37
		C_3	605.55	368.27	224.93	1198.7	99.4	58.7	39.5	197.6	26.5	12.0	8.1	46.6	45.6	27.7	17.8	91.1
		C_4	655.47	465.29	267.23	1387.9	124.7	81.7	54.4	260.8	23.4	15.5	10.3	49.2	51.6	34.9	22.1	108.6
	B_3	C_1	486.15	338.24	227.11	1051.5	84.2	47.0	27.3	158.5	16.5	9.3	5.3	31.1	45.1	25.9	14.3	85.3
		C_2	482.30	423.46	256.83	1162.5	84.2	65.0	45.1	194.3	16.8	13.1	9.1	39	43.3	34.5	22.8	100.6
		C_3	572.25	445.67	272.86	1290.8	100.2	72.7	50.6	223.5	18.1	13.4	9.3	40.8	47.6	35.6	23.7	106.9
		C_4	677.64	469.86	334.43	1481.9	138.0	87.5	67.6	293.1	22.0	14.1	10.9	47	56.0	36.6	27.1	119.7
	B_4	C_1	639.83	390.95	227.40	1258.1	100.6	54.4	33.7	188.7	16.2	8.9	5.5	30.6	56.1	31.3	18.5	105.9
		C_2	724.67	493.55	246.96	1465.1	118.4	77.9	40.5	236.8	18.4	12.2	6.3	36.9	64.2	43.6	21.6	129.4
		C_3	721.02	538.26	282.30	1541.5	121.8	86.0	53.5	261.3	19.0	13.6	8.4	41	64.7	47.1	28.0	139.8
		C_4	818.63	689.77	388.96	1897.3	164.7	123.6	73.3	361.6	22.6	17.2	10.2	50	81.1	62.8	35.5	179.4
LSD 0.05			**135.0**	**89.11**	**54.61**	**182.7**	**4.90**	**4.52**	**1.40**	**2.00**	**0.64**	**0.64**	**0.64**	**0.60**	**2.32**	**2.58**	**1.11**	**2.81**

Treatment			Fresh forage yield (t fad.$^{-1}$)								Dry forage yield (t fad.$^{-1}$)							
			2006				2007				2006				2007			
			Cut_1	Cut_2	Cut_3	Acc. yield	Cut_1	Cut_2	Cut_3	Acc. yield	Cut_1	Cut_2	Cut_3	Acc. yield	Cut_1	Cut_2	Cut_3	Acc. yield
A_1	B_1	C_1	7.35	5.25	4.20	16.80	6.25	5.18	4.08	15.50	1.91	1.38	1.11	4.40	1.78	1.53	1.32	4.64
		C_2	10.50	6.83	4.73	22.05	9.58	5.58	4.65	19.80	2.69	1.78	1.23	5.70	2.60	1.66	1.48	5.74
		C_3	11.55	7.35	5.25	24.15	9.50	6.88	5.13	21.50	2.57	1.90	1.39	5.86	2.69	2.05	1.60	6.34
		C_4	13.13	8.40	5.25	26.78	11.68	7.88	5.23	24.78	3.27	2.13	1.40	6.79	3.16	2.32	1.62	7.10
	B_2	C_1	12.08	8.93	4.20	25.20	10.83	8.30	3.88	23.00	3.07	2.38	1.06	6.51	2.97	2.40	1.29	6.67
		C_2	12.08	9.45	5.78	27.30	11.58	8.42	5.70	25.70	2.94	2.48	1.41	6.83	3.17	2.38	1.83	7.39
		C_3	14.18	9.98	6.30	30.45	13.15	9.30	6.88	29.33	3.37	2.51	1.57	7.45	3.71	2.64	2.17	8.52
		C_4	15.23	12.60	7.35	35.18	14.03	11.33	7.07	32.43	3.60	3.31	1.73	8.63	3.77	3.23	2.19	9.19
	B_3	C_1	12.60	9.98	5.78	28.35	11.45	10.00	5.13	26.58	3.25	2.54	1.48	7.27	2.91	2.75	1.67	7.33
		C_2	13.13	11.03	5.78	29.93	12.17	10.30	5.25	27.73	3.35	2.72	1.52	7.59	3.23	2.87	1.72	7.82
		C_3	15.75	12.60	7.35	35.70	14.03	11.28	7.08	32.38	3.85	3.13	1.79	8.77	3.72	3.09	2.30	9.11
		C_4	16.28	13.13	7.88	37.28	13.28	12.60	7.10	32.98	3.92	3.40	1.94	9.26	3.65	3.46	2.28	9.39
	B_4	C_1	14.18	9.98	5.78	29.93	13.70	8.93	5.83	28.45	3.71	2.51	1.46	7.68	3.24	2.61	1.94	7.79
		C_2	15.23	11.55	6.30	33.08	13.77	10.83	6.95	31.55	3.87	2.73	1.66	8.26	3.47	3.04	2.31	8.81
		C_3	15.75	13.65	8.40	37.80	14.08	13.13	7.15	34.35	3.88	3.13	2.05	9.07	3.66	3.63	2.40	9.68
		C_4	19.43	15.23	9.98	44.63	15.08	13.85	9.58	38.50	4.58	3.43	2.43	10.43	3.93	3.77	3.00	10.70
A_2	B_1	C_1	7.88	5.78	4.20	17.85	6.55	5.38	4.04	15.96	1.82	1.51	1.12	4.45	1.88	1.60	1.29	4.71
		C_2	8.93	6.30	3.68	18.90	7.43	6.00	4.075	17.50	2.06	1.64	1.04	4.74	2.06	1.69	1.36	5.11
		C_3	9.45	7.35	4.20	21.00	7.33	6.75	4.43	18.50	2.36	1.84	1.16	5.37	2.07	1.87	1.46	5.40
		C_4	11.55	7.35	4.20	23.10	9.75	7.00	4.32	21.08	2.89	1.81	1.11	5.81	2.60	1.98	1.44	6.02
	B_2	C_1	7.35	5.25	3.15	15.75	6.75	5.20	4.00	15.95	1.88	1.29	0.87	4.05	1.94	1.58	1.38	4.91
		C_2	7.88	6.83	3.68	18.38	7.13	5.85	4.08	17.05	1.98	1.70	1.01	4.68	1.99	1.74	1.35	5.09
		C_3	11.03	6.83	4.20	22.05	9.58	5.98	4.15	19.70	2.71	1.72	1.13	5.56	2.66	1.75	1.38	5.80
		C_4	12.60	8.40	5.25	26.25	9.60	7.93	5.00	22.53	2.84	2.11	1.29	6.24	2.66	2.24	1.64	6.56
	B_3	C_1	8.93	6.30	3.68	18.90	8.05	5.75	4.20	18.00	2.19	1.54	1.08	4.81	2.27	1.72	1.37	5.36
		C_2	8.93	7.88	4.73	21.53	8.58	7.65	4.38	20.60	2.10	1.91	1.20	5.21	2.36	2.29	1.39	6.04
		C_3	10.50	8.40	4.73	23.63	9.00	7.75	4.83	21.58	2.42	1.97	1.24	5.64	2.43	2.26	1.57	6.26
		C_4	12.60	8.93	5.25	26.78	10.93	7.98	4.77	23.68	2.79	2.01	1.48	6.28	2.78	2.33	1.58	6.69

	B_4	**C_1**	9.98	6.83	3.68	20.48	8.30	6.50	4.13	18.93	2.61	1.63	1.00	5.23	2.34	2.00	1.35	5.70
		C_2	11.55	8.93	4.20	24.68	9.70	8.13	4.58	22.40	2.90	2.04	1.07	6.01	2.72	2.65	1.51	6.88
		C_3	11.55	9.45	4.73	25.73	9.92	8.25	4.65	22.83	2.84	2.20	1.20	6.25	2.81	2.55	1.52	6.87
		C_4	13.60	12.05	6.83	32.48	11.50	10.83	5.90	28.23	3.14	2.73	1.61	7.49	3.02	3.10	1.92	8.04
LSD 0.05			**1.29**	**0.99**	**1.13**	**2.29**	**0.97**	**0.76**	**0.42**	**1.35**	**0.44**	**0.19**	**0.25**	**0.54**	**0.29**	**0.19**	**0.18**	**0.42**

A = T

ime of K application (A_1 = during sowing, A_2 = after 21 day from sowing) B = K_2O levels (B_1 = zero, B_2 = 50, B_3 =100 and B_4 = 150 (Kg/ fad.) C = FYM levels (C_1 = z

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