

PHOSPHORUS FERTILIZATION AND FOLIAR SPRAY WITH "GREENZIT" ON COWPEA YIELD AND QUALITY

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ABSTRACT

The present investigation was conducted at Shandaweel Agriculture Station, Sohag Governorate, Egypt, in the two successive Summer seasons of 1996 and 1997, to study the effect of four levels of phosphorus fertilizer i.e., 0, 30, 45 and 60 kg P₂O₅ / fed in the form of calcium super phosphate (15.5% P₂O₅) and number of foliar sprays with "Greenzit" fertilizer (1 cm / liter) i.e., once, twice and three times on yield and quality of cowpea cv. "Cream 7". The obtained results indicated that : plant height, number of branches, early fresh yield, total fresh yield, dry seed yield, average weight of 100 seeds, shellout %, protein and phosphorus % in dry seeds were significantly increased when cowpea plants were fertilized with 60 kg P₂O₅ / fed. and sprayed 3 times with "Greenzit" fertilizer after 30, 45 and 60 days from sowing.

INTRODUCTION

Cowpea (*Vigna unguiculata* L.) Walp) is one of the most important legume crops grown in summer season in Egypt for its highly nutritional value. The total cultivated area of cowpea in Egypt was gradually increased during the last several years. The growing area was estimated by 14170 fed. for dry seeds production in 1995 with a mean value of 950 kg / fed. Also, the estimated area for fresh pods production was 10991 fed with a mean value of 3.15 ton / fed in the same year. Increasing cowpea productivity is an important aim and that may be achieved through some agricultural practices such as phosphorus fertilization and foliar spray fertilizers. Phosphorus plays an important role on growth, yield and yield components of cowpea. In this regards, Singh *et al.* (1989) stated that fertilizing cowpea cv. "Pusa Do phosali" with P₂O₅ at the rates of 0, 60, 80, or 100 kg / ha increased pod yields. The highest pod yield of 3.13 and 3.25 ton / ha were obtained with the application 100 kg of P₂O₅ / ha in the first and second seasons, respectively. Rao and Subramanian (1990) reported that phosphorus fertilizer effectively increased growth, N accumulation in seeds (but decreased N in leaves and stems), harvest index and seed yield of cowpea plants. Sawant *et al.* (1992) found that cowpea cv. "C152" produced seed yield of 1.05, 1.21, 1.53 and 1.58 ton / ha with the treatments of 0,20,40 or

* Data from Agric. Statistics Dept. Agric. Res. Center, Cairo (1995).

60 kg P₂O₅ / ha, respectively. Ntare *et al.* (1993) declared that the application of P₂O₅ effectively increased cowpea seed yield by increasing crop growth rate. Santhakumari *et al.* (1994) stated that the application of 15,30 or 45 kg P₂O₅ / ha to cowpea plants produced seed yields of 1094, 1179 and 1205 kg / ha., respectively. Marschner (1995) mentioned that, phosphorus deficiency led to a general reduction in most metabolic processes including cell division, expansion, respiration and photosynthesis. The level of P supply during the productive stage, regulated the starch / sucrose ratio which affected the phytohormone balance. Phosphorus is an essential component for energy transfer compounds, the genetic information system, cell membrane and phosphoproteins. Okeleye and Okelana (1997) investigated the effect of phosphorus application (0, 30, and 60 kg P₂O₅ / ha) on six cowpea cultivars and showed that the high P₂O₅ rate of significantly reduced number of days to 50% flowering by 5-8 days. Number of days to 50% flowering was inversely related to P₂O₅ level in all cultivars. Seed yield of cv. "LT 86 D 1038" averaged 1083 kg / ha at zero kg P₂O₅ / ha and 2288 kg / ha at 60 kg P₂O₅ / ha. Similar increases in yields were noted in other tested cultivars except in "LT 86 D-444", which gave its highest average yield of 2423 kg / ha. At 30 kg P₂O₅ / ha and decreased to 2306 kg / ha at 60 kg P₂O₅ / ha. Hendawy and Barsoum (1999) concluded that fertilization of cowpea plants with P₂O₅ significantly increased plant height, number of branches / plant, fresh and dry weights, pod yield / fed., 100-seed weight, seed yield / fed and dry matter content of P% and protein % when P₂O₅ levels increased from 15 up to 45 kg P₂O₅ / fed. On the other hand, no significant changes in number of seeds / pod were found in the two studied seasons.

MATERIALS AND METHODS

The present study was carried out to investigate the effect of phosphorus fertilizer and foliar spray with "Greenzit" fertilizer on yield and quality of cowpea cv. "Cream 7". This study was conducted at Shandaweel Agric. Research Station, Sohag Governorate, Egypt.

Data on soil physical and chemical analysis are shown in Table 1.

Table 1 : Mean of Physical and chemical analysis of the experimental soil before conducting the experiments.

Anions	Conc ml/100g analysis	Cations	Conc ml / 100g		Other
CO ₃ ⁼	Absent	Ca ⁺⁺	0.98	T.T.S.	0.12%
HCO ₃ ⁻	1.07	Mg ⁺⁺	0.71	pH	7.7
CL	0.57	Na ⁺	0.40	CaCO ₃	1.02%
SO ₄ ⁻	0.55	K ⁺	0.98	O.M	0.9%

Soil texture: Sandy loam

Soil fertility: Available N = 50 ppm P= 9.9 ppm K = 141 ppm

The preceding crop in the experimental sites prior to the present study were Egyptian clover (*Trifolium alexandrinum*), in both seasons. The

experimental field were prepared and shaped to ridges 50 cm. wide and 3.5 m long. Each experimental plot was 3 x 3.5 m, which consisted of six ridges. Seeds of cowpea cv. "cream 7" were sown on the first of May in 1996 and 1997 seasons in hills at 10cm apart on one side of the ridge. Growing plants were thinned to two plants per hill after 17 days from planting. The normal culture procedures known for commercial. cowpea production other than the applied treatments were followed. Two ridges from each experimental plot were taken to determine the fresh yield parameters and the other four ridges were used to estimates the dry yield characters.

The treatments were arranged in a split plot system in a randomized complete blocks design with four replicates. Four levels of phosphorus were used i.e., 0,30,45 and 60 kg. P₂O₅ / fed where they were distributed at random in the main plots and applied after 18 days from planting. Phosphorus was applied in the form of calcium super phosphate (15.5% P₂O₅). The commercial foliar spray "Greenzit" at a concentration of 1 cm. per liter was sprayed once (after 30 days from sowing), twice (after 30 and 45 days from sowing) or three times (after 30, 45 and 60 days from sowing). "Greenzit" treatments were distributed randomly in the sub plots. The "Greenzit" components are illustrated in Table 2.

After 120 days from planting ten plants from each plot were taken randomly to determine plant height "cm" number of branches/plant.

The following data were recorded:

A- Fresh pod yield characters:

Seven harvests were done, where cowpea pods were picked at six days interval then the following data were recorded:

Table 2: The components of "Greenzit" fertilizer (elements concentration per liter).

Element	Concentration	Element	Concentration
Cu	10 m/g	N	70 g
Fe	1000 "	P ₂ O ₅	30 "
B	100 "	K ₂ O	3.9 "
Co	1 "	Mg	100 m/g
Mo	5 "	Mn	100 "
		Zn	50 "

1- Early fresh pods yield; pod weight of the first and second harvest were considered to be early yield (ton / fed).

2- Total fresh pods yield (ton / fed).

3- Pod filling % calculated from thirty fresh pods taken at random from each plot at the second harvest according to Remison (1978) as

$$\text{follows: Pod filling \%} = \frac{\text{No. of seeds / pod}}{\text{fresh pod length (cm)}} \times 100$$

Harvesting of dry pods was carried out three times before dropping off seeds and the following data were recorded:

1- Dry seed yield (ton / fed)

2- Average weight of 100 seeds (g).

3- Shellout percentage (%), where:

$$\text{Shellout percentage} = \frac{\text{Dry seed yield}}{\text{Dry pod yield}} \times 100$$

Random samples of seeds were taken after harvest and dried at 70 °C. The dried samples were ground and used for the determination of nitrogen (N) and phosphorus (P). Nitrogen was determined by the modified macro Kjeldahl's methods (A.O.A.C.1980) and phosphorus was determined colorimetrically.

All obtained data were subjected to the statistical analysis and the treatment means were compared using the L.S.D. test according to Steel and Torrie (1981).

RESULTS AND DISCUSSION

Plant height (cm):

Data in Table (3) showed that phosphorus application showed a significant effect on plant height. In addition, there was a continuously increase in plant height with increasing P₂O₅ rate up to the highest level of 60 kg P₂O₅ /fed in the first season and with 45 kg P₂O₅/fed in the second season. The enhancing effect of phosphorus in this respect might attributed to its importance in stimulating the biosynthesis of organic nutrients as well as improving both cell division and cell enlargement in plant tissues; Rizk (1995). The obtained results in the present study are in harmony with those reported by Hassan *et al.* (1990) and Hendawy and Barsoum (1999). The effect of spraying "Greenzit" fertilizer on plant height was approved from the statistical point of view (Table 3). Plant height was increased as number of sprays was increasing In this regard spraying "Greenzit" fertilizer 3 times gave the highest significant increase in the two seasons. These results might be due to the effect of increasing the sprayed macro-elements i.e. N,P,K and Mg and micro-elements, i.e. Mn Zn, Cu, Fe, B, Co and Mo (Table 2) through a wide period from 30 to 60 days after planting. Spraying this quantity of macro and microelements could enhance cowpea plants growth and hence increased plant height. The same trend was observed in both seasons.

Results in Table (3) showed that the interaction between the two studied factors caused a significant increase in plant height only in the second season. The tallest plants were obtained when plants were fertilized with 45 kg P₂O₅/fed and sprayed three times with "Greenzit" fertilizer at 15 days intervals.

Number of branches/plant:

Data presented in Table (3) showed that number of branches per plant was significantly increased with increasing phosphorus levels up to the highest rate of 60 kg P₂O₅/fed However, the differences were more pronounced and statistically approved only in the first season of this experiment. This positive effect might be due to stimulating the biosynthesis of organic nutrients and improving cell division. These results are in

accordance with those found by Hassan *et al.* (1990) and Hendawy and Barsoum (1999).

The obtained results showed also that the foliar sprays with "Greenzit" fertilizer significantly increased number of branches per plant, in both seasons. However, the highest values of these traits were obtained from spraying "Greenzit" fertilizer three times at 15 days intervals. Data in Table (3) of the interaction between both studied factors showed also, that number of branches per plant was gradually increased as a results of increasing both phosphorus fertilizer rate and number of spraying with "Greenzit" fertilizer but the differences were more announced and statistically approved in the first season of the present study.

Pod filling percentage:

Data presented in Table (3) showed that phosphorus fertilizer increased pod filling up to the highest phosphorus rate when compared to the unfertilized treatment. The differences were significant in the first season only. Spraying with "Greenzit" fertilizer failed to show any significant effect on pod filling percentage, in both seasons. The interaction between phosphorus fertilizer and number of sprays with "Greenzit" fertilizer. had a significant effect on pod filling percentage in the first season only. Pod filling% was the highest when cowpea plants fertilized with 60 kg P₂O₅ / fed. and sprayed 3 times with "Greenzit" fertilizer.

Early fresh pod yield (ton / fed):

Data presented in Table (3) showed that Phosphorus fertilizer significantly increased the early fresh pod yield of cowpea plants, in both seasons. The two treatments of applying 30 or 45 kg P₂O₅ / fed were not significantly different from each other in their effect but their early yield were significantly higher than the unfertilized treatment in the second season. The highest early fresh pod yield was obtained from the treatment of 60 kg P₂O₅ / fed. in both seasons. Spraying "Greenzit" fertilizer significantly increased early fresh pod yield of cowpea plants (Table 3). The early fresh yield was increased as number of sprays with "Greenzit" fertilizer was increased, in both seasons. The highest values (1.211 and 1.574 tons /fed.) were obtained from spraying "Greenzit" fertilizer three times at 15 days intervals compared to the lowest values (0.961 and 1.177 ton / fed) obtained from spraying "Greenzit" fertilizer once after 30 days from sowing.

The interaction between P fertilizer levels and "Greenzit" treatments significantly affected early fresh pod yield of cowpea plants, in both seasons. The lowest early fresh pod yield was obtained from the unfertilized plants with P and sprayed once with "Greenzit" fertilizer. Whereas, the highest early fresh pod yield was recorded when cowpea plants were fertilized with 60 and 45 kg P₂O₅ in addition to spraying "Greenzit" 3 times, in the first and second season, respectively.

Table 3: Effect of phosphorus fertilizer and number of foliar sprays with "Greenzit" fertilizer on plant height , number of branches/plant, pod filling %, early fresh yield and total fresh yield in 1996 and 1997 seasons.

Treatments "A"		Plant height (cm)		Number of branches/plant		Pod filling %		Early fresh yield (ton/fed)		Total fresh yield (ton/fed.)	
P ₂ O ₅ Kg/fed.	Number of foliar sprays with "Greenzit"	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997
0	Once	74.63	87.78	5.43	7.90	62.43	69.05	0.733	0.944	3.480	3.718
	Twice	78.23	91.55	6.03	8.38	64.55	72.78	0.809	1.077	3.625	4.189
	3 times	81.90	91.60	6.53	9.95	67.63	66.75	0.938	1.230	3.989	4.872
Mean of "A"		78.25	90.31	5.99	8.41	64.87	69.53	0.827	1.084	3.698	4.260
30	Once	79.78	95.05	6.15	7.83	69.13	69.80	0.998	1.279	4.125	3.838
	Twice	83.95	95.98	6.58	8.35	66.43	70.60	1.029	1.443	4.211	4.330
	3 times	89.85	104.15	6.95	8.85	63.40	68.20	1.202	1.611	4.332	4.834
Mean of "A"		84.53	98.39	6.56	8.34	66.32	69.53	1.076	1.445	4.223	4.334
45	Once	84.00	104.93	6.48	8.45	68.80	69.55	0.946	1.052	3.983	3.906
	Twice	87.45	106.05	6.93	8.83	72.38	66.70	1.128	1.600	4.082	4.742
	3 times	90.53	110.83	7.63	8.88	65.15	71.35	1.229	1.807	4.261	5.422
Mean of "A"		87.33	107.27	7.01	8.72	68.78	69.20	1.101	1.487	4.109	4.690
60	Once	89.23	106.90	7.25	8.63	71.68	74.38	1.168	1.431	4.106	4.291
	Twice	90.73	102.48	8.05	8.90	72.13	67.05	1.458	1.576	4.325	4.699
	3 times	94.33	103.30	8.95	8.83	81.85	69.58	1.477	1.649	4.324	4.946
Mean of "A"		91.43	104.23	8.08	8.78	75.22	70.33	1.368	1.552	4.252	4.645
Mean of "B" "Greenzit" sprays	Once	81.91	98.66	6.33	8.20	69.31	70.69	0.961	1.177	3.923	3.938
	Twice	85.09	99.01	6.89	8.61	68.43	69.28	1.106	1.424	4.061	4.490
	3 times	89.15	102.47	7.51	8.88	68.74	68.97	1.211	1.574	4.226	5.018
L.S.D at 5%	A	2.54	2.72	0.18	NS	5.34	NS	0.03	0.13	0.03	0.11
	B	1.36	2.00	0.11	0.32	NS	NS	0.02	0.11	0.02	0.02
	AB	NS	3.99	0.23	NS	6.91	NS	0.05	0.22	0.05	0.17

Total fresh pod yield (ton / fed):

The presented data in Table (3) showed that total fresh pod yield was significantly increased as P fertilizer level was increased, in both seasons. The highest total fresh pod yields of 4.25 and 4.69 ton / fed were obtained when cowpea plants fertilized with 60 and 45 kg P₂O₅ / fed., in the first and second seasons, respectively. These results might be attributed to the beneficial effect of phosphorus on cell division and the formation of carbohydrates (Nijjar 1985). These results agreed with those reported by Hassan *et al.* (1990). The illustrated data in Table (3) demonstrated that increasing number of sprays with "Greenzit" fertilizer significantly increased total fresh pod yield of cowpea plants, in both seasons. The highest values (4.23 and 5.02 ton / fed) were resulted from spraying "Greenzit" fertilizer three times after 30, 45 and 60 days from sowing. On the other hand, the lowest values (3.92 and 3.94 ton/fed) were obtained from spraying "Greenzit" fertilizer once (30 days after sowing). These results might be related to receiving more levels of macro and microelements existed in "Greenzit"

fertilizer in plants sprayed three times Table (2) and its improving effect on stimulating the biosynthesis of organic nutrients and enhancing the uptake of minerals which consequently improved the yield (Nijjar, 1985). Similar results were obtained by Tadrus (1991).

Considerable influence was detected owing to the studied combination between the two studied factors in the two experimental seasons. The highest values were produced when plants were fertilized with P at the rate of 60 kg P₂O₅ / fed. and sprayed three times with "Greenzit" fertilizer in both seasons.

Dry seeds yield (ton / fed)

Data presented in Table (4) showed that phosphorus fertilizer significantly increased cowpea dry seeds yield when compared to the control (zero P₂O₅) in both seasons. The two treatments of 30 and 45 kg P₂O₅ / fed did not differ significantly in their dry seeds yield per fed in the first season, whereas the treatment of 60 kg P₂O₅ / fed significantly produced the highest dry seeds yield, in the two seasons. The response of cowpea plants to phosphorus fertilizer might be attributed to the beneficial effect of phosphorus

on cell division and the formation of carbohydrates (Nijjar, 1985). These results concerning the improving effect of phosphorus are in agreement with those found by Hassan *et al.* (1990); Mahaldar *et al.* (1991), Okeleye and Okelana (1997) and Hendawy and Barsoum (1999).

Data in Table (4) showed that increasing number of foliar sprays with "Greenzit" fertilizer significantly increased cowpea dry seeds yield. However, spraying "Greenzit" fertilizer twice gave a higher seed yield than the 3 times spraying, in the first season. Data in Table (4) indicated that the interaction between the two studied factors significantly increased dry seed yield of cowpea plants but only in the first season. In this respect, the plants that fertilized with 60 kg P₂O₅ / fed and sprayed twice with "Greenzit" fertilizer produced the highest dry seed yield/fed in the first season .

Average weight of 100 seeds (g):

Results in Table (4) indicated that increasing phosphorus fertilizer up to 60 kg P₂O₅ / fed significantly increased average weight of 100 seeds, in the first season. However, the highest values for weight of 100 seeds were obtained from plants fertilized at the rate of 60 kg P₂O₅ / fed. in both seasons. These results might attributed to the beneficial effect of phosphorus on encouraging cell division, cell enlargement, the formation and movement of carbohydrates (Nijjar, 1985). These results are in agreement with those found by Hendawy and Barsoum (1999).

Table 4: Effect of phosphorus fertilizer and number of foliar sprays with “Greenzit” fertilizer on dry seed yield, average weight of 100 seeds and shellout percentage of cowpea plants in 1996 and 1997 seasons.

“A”		Treatments “B”		Dry seed yield (ton/fed.)		Average weight of 100 seeds (g)		Shellout percentage %	
P ₂ O ₅ Kg/fed.	Number of foliar sprays with “Greenzit”	1996	1997	1996	1997	1996	1997	1996	1997
0	Once	0.732	0.877	13.58	15.55	62.50	53.10		
	Twice	0.841	0.947	14.38	14.95	66.50	58.95		
	3 times	0.931	1.050	15.23	14.50	70.50	61.55		
Mean of “A”		0.825	0.958	14.39	15.00	66.50	57.87		
30	Once	0.853	0.944	14.83	13.53	67.25	52.15		
	Twice	0.997	1.013	15.45	14.78	72.00	56.55		
	3 times	0.850	1.146	16.03	14.83	70.25	66.03		
Mean of “A”		0.900	1.034	15.43	14.38	69.83	58.24		
45	Once	0.895	0.943	15.08	14.35	70.00	68.13		
	Twice	0.953	1.066	16.13	15.43	71.50	66.55		
	3 times	0.861	1.134	16.63	15.23	70.75	57.35		
Mean of “A”		0.903	1.048	15.94	15.00	70.75	64.01		
60	Once	0.879	1.062	16.18	15.08	72.00	65.55		
	Twice	0.988	1.138	18.13	15.50	67.25	65.63		
	3 times	0.924	1.218	18.25	17.83	72.25	70.93		
Mean of “A”		0.930	1.139	17.52	16.13	70.50	67.37		
Mean of “B” “Greenzit” sprays	Once	0.840	0.957	14.91	15.13	67.94	59.73		
	Twice	0.945	1.041	16.02	15.16	69.31	61.92		
	3 times	0.981	1.137	16.53	15.09	70.94	63.96		
LSD at 5%									
Phosphorus “A”		0.04	0.08	0.49	0.33	2.20	5.31		
Greenzit “B”		0.02	0.03	0.15	N.S.	1.91	2.63		
Interaction AxB		0.05	N.S.	0.31	0.96	3.81	3.27		

Data in Table (4) revealed that spraying “Greenzit” fertilizer increased weight of 100 seeds with a significant effect, in the first season. The three times treatment produced the highest value. The effect of increasing number of sprays with “Greenzit” fertilizer provided a favorable nutritional status in plant and consequently improved the 100 seeds weight. Regarding the effect of the interaction between the two studied factors, results presented in Table (4) indicated that weight of 100 seed significantly increased as phosphorus rate and number of sprays with “Greenzit” were raised, where the heaviest weight was obtained from plants fertilized with 60 kg P₂O₅ / fed and sprayed three times with “Greenzit”, in both seasons.

Shellout percentage:

Data in Table (4) showed that phosphorus application significantly increased shellout percentage with increasing the application rate up to 60 kg P₂O₅ / fed. in both seasons. These results might be attributed to the increases in dry seeds yield and weight of 100 seeds as a result of increasing

P₂O₅ rates . Data in Table (4) showed also, that increasing number of sprays with “Greenzit” fertilizer significantly increased shellout percentage in both seasons. These increases could be explained in the light of the increases in dry seeds yield (ton / fed) and weight of 100 seeds (g) as a result of increasing number of sprays with “Greenzit” fertilizer. The interaction between the two studied factors had a significant effect on shellout percentage. The treatment of 60 kg P₂O₅ / fed. and 3 sprays with “Greenzit” fertilizer gave the highest values of shellout percentage, in both seasons.

Protein percentage in the dry seed:

Data in Table (5) showed that protein percentage in dry seeds was significantly affected by phosphorus fertilizer, in both seasons. Protein percentage was gradually increased with increasing phosphorus fertilizer up to the highest rate i.e. 60 kg P₂O₅ fed. These results are confirmed with those found by Antuono *et al.* (1984) who found that the application of phosphorus fertilizer noticeably improved protein in dry seeds of pea plants. Similar results were reported by Hendawy and Barsoum (1999).

A progressive increment was induced in the percentage of protein in dry seeds due to spraying “Greenzit” fertilizer. The highest values (24.74 and 24.68 %) were obtained from spraying the foliar fertilizer “Greenzit” 3 times, whereas the lowest values (21.82 and 21.65 %) were resulted from spraying “Greenzit” once in the first and second seasons, respectively. Concerning the effect of interaction between the two studied factors on protein percentage of cowpea seeds, data in Table (5) obviously revealed that this interaction significantly affected this trait in both seasons. However, the highest values were resulted from plants fertilized with the highest phosphorus fertilizer rate of 60 kg P₂O₅ / fed. and sprayed three times with “Greenzit”.

Phosphorus percentage in dry seeds:

Data presented in Table (5) indicated that phosphorus fertilizer significantly increased this trait in both seasons. The highest values (0.626 and 0.633%) were obtained from the highest phosphorus rate of 60 kg P₂O₅ / fed. However, the lowest values (0.423 and 0.456) were resulted from the unfertilized plants in the first and second seasons respectively. These results are in harmony with those reported by Hendawy and Barsoum (1999).

Table 5: Effect of phosphorus fertilizer levels and number of foliar sprays with “Greenzit” fertilizer on the percentages of protein and phosphorus in the dry seeds in 1996 and 1997 seasons.

Treatments		protein % in the dry seeds		Phosphorus % in the dry seeds	
“A”	“B”	1996	1997	1996	1997
P ₂ O ₅ Kg/fed.	Number of foliar sprays with “Greenzit”				
0	Once	19.327	18.750	0.383	0.388
	Twice	19.937	19.750	0.415	0.410
	3 times	21.057	21.00	0.470	0.570
	Mean of “A”	20.170	19.833	0.423	0.456
30	Once	21.330	21.190	0.520	0.532
	Twice	22.520	22.197	0.558	0.558
	3 times	23.480	23.598	0.605	0.612
	Mean of “A”	22.563	22.328	0.561	0.568
45	Once	22.865	22.775	0.547	0.548
	Twice	24.005	24.133	0.570	0.582
	3 times	23.480	25.952	0.623	0.692
	Mean of “A”	24.142	24.287	0.580	0.592
60	Once	23.740	23.895	0.578	0.575
	Twice	25.995	25.863	0.627	0.645
	3 times	28.492	28.160	0.672	0.680
	Mean of “A”	26.076	25.973	0.626	0.633
Mean of “B” “Greenzit” sprays	Once	21.816	21.653	0.507	0.511
	Twice	23.114	22.986	0.542	0.549
	3 times	24.736	24.678	0.593	0.599
LSD at 5%	A	0.69	0.34	0.03	0.03
	B	0.41	0.36	0.01	0.01
	AB	0.82	0.66	NS	0.01

Spraying “Greenzit” fertilizer significantly increased phosphorus percentage in the dry seeds of cowpea plants Table (5). This character was increased as number of sprays with “Greenzit” fertilizer increased, in both seasons. The highest values were obtained from spraying “Greenzit” fertilizer three times at 15 days interval, whereas the lowest values were obtained from spraying “Greenzit” fertilizer once after 30 days from sowing, in both seasons.

The interaction between the two studied factors was significant in the second season only, where the highest value was obtained from plants fertilized with 60 kg P₂O₅ / fed. and sprayed 3 times with “Greenzit” fertilizer.

In general, based on the obtained results in the present study, it may be recommended to apply phosphorus fertilizer at the rate of 60 Kg P₂O₅/fed. after about two weeks from sowing cowpea cv. “Cream7” and spraying plants 3 times with “Greenzit” fertilizer at 15 days intervals after 30, 45 and 60 days from sowing to increase the productivity of fresh pods and dry seeds as well as improving their quality at similar conditions to that the present study.

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تأثير التسميد الفوسفوري والرش الورقي بسماد الجرينزيت على محصول وجودة نباتات اللوبيا

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**مركز البحوث الزراعية - شندويل -وزارة الزراعة -مصر

أجريت هذه الدراسة خلال موسمي 1996 ، 1997 على نباتات اللوبيا "صنف كريم 7" في مزرعة محطة البحوث الزراعية بشندويل / محافظة سوهاج - مصر . وذلك بغرض دراسة تأثير أربعة مستويات من التسميد الفوسفوري صفر ، 30 ، 45 ، 60 كجم فوسفور أ₅ /فدان والرش بالسماد الورقي "جرينزيت" بمعدل 1 سم /لتر مرة (بعد 30 يوم من الزراعة) ومرتين (بعد 30 و 45 يوم من الزراعة) وثلاث مرات (بعد 30 و 45 و 60 يوم من الزراعة) على المحصول وجودته في اللوبيا "صنف كريم 7" . أوضحت النتائج المتحصل عليها زيادة كل من طول النبات وعدد الأفرع/نبات والمحصول المبكر والمحصول الكلي للقرون الخضراء وكذلك المحصول البذري الجاف ووزن الـ 100 بذرة والنسبة المئوية للتصافي والنسبة المئوية للبروتين والفوسفور في البذور الجافة. زيادة معنوية عند معاملة نباتات اللوبيا بمستوى 60 كجم فوسفور أ₅ مع رشها ثلاث مرات بالسماد الورقي "جرينزيت" بعد 30 ، 45 ، 60 يوم من الزراعة وهذه المعاملة يمكن أن يوصى بها عند زراعة اللوبيا "صنف كريم 7" تجارياً في الظروف المشابهة لتلك التي أجريت فيها هذه الدراسة.