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EFFECT OF DIFFERENT LEVELS OF N AND DIFFERENT SOURCES AND RATES OF P ON GROWTH, YIELD AND CRUDE PROTEIN IN FORAGE SORGHUM

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ABSTRACT

The present study was carried out at Sakha Agricultural Research Station during 1996 and 1997 seasons to study the effect of different levels of N (0, 60, 90 and 120 kg/fad) and sources of P (mono calcium phosphate and triple phosphate) under three rates 0, 15 and 30 kg P_2O_5/fad on growth, productivity and crude protein of forage sorghum "cv local hybrid 102" and balance between nitrogen and phosphorus. Randomized complete block design with four replications was used. Combined analysis of variances was done for total fresh and dry forage yield over both seasons. It was found that high levels of N and P encouraged plant growth and gave the tallest plants, with thick stem diameter. Fresh and dry forage yield, and crude protein content were increased by increasing nitrogen and phosphorus levels at all cuts in both seasons. The addition of (120 kg N + 15 kg P_2O_5 monocalcium phosphate)/fad was the superior. It produced 56.35 and 49.70 ton/fad fresh forage yield in 1996 and 1997 seasons, and 8.155 and 6.642 ton/fad dry forage yield in both seasons also, respectively. Also it had the highest leaf/stem ratio (fresh and dry) with higher crude protein content.

INTRODUCTION

Forage sorghum is widely grown in tropical and subtropical areas. In Egypt, it is considered one of the most important forage in summer crops, where a great need for green fodder to feed livestock has been increased. Therefore, great efforts have been directed towards improving sorghum forage crop through releasing the suitable genotypes and optimizing the agronomic practices. As one of great factors, proper fertilization needs to be exclusively investigated. Plopsoreanu and Cimponeru (1970) reported that sorghum x sudangrass hybrid gave high yields with 80 kg N + 40 kg P_2O_5/ha while Lingegowda *et al.* (1971) stated that sorghum hybrid Csh.1 fertilized by 45 kg P_2O_5 + 22 kg K_2O/ha as well as 67 kg N/ha as a single application at sowing, or as 2-3 split applications gave about 2-3 ton/ha of dry yield. Roy (1971) indicated that sorghum hybrid Csh. 1 which received 120 kg N and 26 kg P_2O_5/ha individually or in combination in addition to 24 kg K_2O/ha as basal top dressing resulted in the highest dry forage yield (3.7 t/ha). Abdella and Darwish (1972) found that application of 120 kg N and 100 kg P_2O_5/fad to grasses yearly and cutting once every 3 months gave the highest green yield compared to control. Sennik (1972) showed that application of 45 kg N + 45 kg P_2O_5/ha to sudangrass increased fodder yields in 3 cuts about 10.5 t/ha compared with control (zero N and P) which produced about 3.6 t/ha. Fornaworth (1973) found that hybrid sorghum cv. Beef Builder which received 35-50 kg N + 100 - 200 kg P_2O_5/ha in 6 split applications applied monthly produced dry matter yield, about 7-11 t/ha when cut 3 times during 213 days. Abd El-Gawad (1976) found that plant height, fresh or dry yields and crude protein content of the two sorghum cultivars were increased by increasing nitrogen levels upto 45 kg N/fad/each cutting. Abdel-Gawad and Sharaan

(1986) reported that dry matter yield was significantly increased with applying 45 kg N/fad at two equal split applications; after planting and after the first cutting. Gheit *et al.* (1995) found that plant height, stem diameter, fresh and dry forage yield as well as crude protein of sorghum hybrid plant were significantly increased by increasing N levels upto 90 kg N/fad. Application of 31 kg P_2O_5/fad significantly increased plant height, stem diameter, fresh and dry forage yield in one season and led to unobvious effect on the another seasons. Bassal *et al.* (1997) found that nitrogen fertilizer levels had marked effects on plant height, fresh and dry forage yield and crude protein percentage up to 30 kg N/fad/cut.

The main objective of this work was to study the effect of different N levels, and different sources and rates of phosphorus on sorghum fresh and dry forage yields and its quality as well as some important characters (plant height, stem diameter, and fresh and dry leaf/stem ratio).

MATERIALS AND METHODS

This study was carried out at Sakha Agricultural Research Station during the two successive seasons 1996 and 1997. A randomized complete block design with four replications was used, the plot area was 2 x 3 m. Nitrogen fertilizer was urea 46.5% and phosphorus fertilizer sources were P_2O_5 monocalcium phosphate or triple phosphate. Soil samples were taken for chemical analysis before planting during two seasons (Table 1). Phosphorus applied during the tillage as one dose (two sources) while nitrogen added in three equal doses.

Table (1): Chemical analysis.

Seasons / Variables		1996	1997
pH		8.11	8.10
Total soluble salts	%	0.22	0.21
Calcium carbonate	%	3.72	3.74
Organic matter	%	2.18	2.22
Total nitrogen	%	0.09	0.08
Soluble nitrogen	ppm	26	23
Av.P	ppm	10	9
Av. K	ppm	480	460

First dose of N was added after 21 days from sowing, after first cut and after second cut. Nitrogen levels and different phosphorus levels and sources are shown in Table (2).

The field experiments were planted in May, 24 in 1996 and June, 20, in 1997, following the broadcasting sowing technique with a seed rate of 20 kg/fad. Three cuts were taken during the growing season. Five randomized plants were taken for all the agronomic characters as follows:

1-Plant height (cm).
2-Stem diameter (cm).
3-Leaf/stem ratio (fresh and dry)
4-Fresh forage yield (ton/fad)
5-Dry forage yield (ton/fad)
6-Crude protein content (%) according to A.O.A.C. (1980).

Table (2): Treatments No. of different levels of nitrogen and different sources and rates of phosphorous.

Treat.	N +P fertilizers	Treat.	N +P fertilizers
1	0 + 0	9	90 +15 monocalcium phosphate
2	60 + 0	10	90 + 15 triple phosphate
3	90 + 0	11	90 + 30 monocalcium phosphate
4	120 + 0	12	90 + 30 triple phosphate
5	60 + 15 monocalcium phosphate	13	120+ 15 monocalcium phosphate
6	60 + 15 triple phosphate	14	120+ 15 triple phosphate
7	60 + 30 monocalcium phosphate	15	120 + 30 monocalcium phosphate
8	60 + 30 triple phosphate	16	120+ 30 triple phosphate

Statistical analysis as the usual technique of analysis in randomized complete block design was adopted according to (Gomez and Gomez 1984) and multiple range test and Multiple F-tests following Duncan (1955).

RESULTS AND DISCUSSION

Plant height (cm):

Data presented in Table (3) show that there is clear effect of nitrogen levels and phosphorus sources and levels on plant height in both seasons. Plots which received 120 kg N + 15 kg P_2O_5 monocalcium superphosphate (treatment No. 13) gave the tallest plants. This means that balance between N and P had more effect than N alone. On the other hand, the plots which received 120 kg N + 15 or 30 kg P_2O_5 monocalcium superphosphate or triple phosphate gave the tallest plants also with no significant differences with treatment No. 13. Similar results were obtained by Abd El-Gawad (1970).

Table (3): Effect of different levels of N and different sources and rates of P on plant height (cm) of forage sorghum.

Treatments		1996			1997		
		1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
	N P						
1	0	120.8 k	97.4 g	61.25 e	110.00 c	110.25 c	102.00 c
2	60	127.4 j	110.3 c-e	64.75 b-e	116.25 bc	118.00 bc	112.75 bc
3	90	135.8 f-h	100.6 fg	67.00 b-d	117.00 bc	117.00 bc	112.00 bc
4	120	132.1 hi	114.2 a-d	68.00 bc	137.25 a-c	116.60 bc	120.50 bc
5	60 +15 Mono.	135.1 f-i	108.1 d-e	63.25 c-e	116.80 bc	110.00 c	120.50 bc
6	60 +15 Tri.	137.9 e-g	113.6 b-d	66.00 b-e	115.70 bc	118.50 bc	114.25 bc
7	60 +30 Mono.	134.1 g-i	113.0 b-d	67.75 bc	116.00 bc	117.50 bc	116.25 bc
8	60 +30 Tri.	130.9 ij	112.2 c-e	68.00 bc	116.60 bc	1.80 bc	120.00 bc
9	90 + 15 Mono.	139.4 d-f	113.3 b-d	67.25 b-d	117.60 bc	116.00 bc	121.75 bc
10	90 +15 Tri.	138.4 d-g	112.1 c-e	68.00 bc	114.00 bc	115.00 bc	117.00 bc
11	90 + 30 Mono.	142.9 b-d	133.3 b-d	65.75 b-e	114.00 bc	114.60 bc	116.50 bc
12	90 +30 Tri.	142.1 bc	106.0 ef	62.50 de	117.00 bc	114.00 bc	115.50 bc
13	120 + 15 Mono.	149.1 a	121.0 a	73.00 a	150.75 a	146.00 a	144.25 a
14	120+ 15 Tri.	141.5 g-e	114.2 a-d	68.25 ab	135.50 a-c	137.00 ab	127.75 ab
15	120 + 30 Mono.	146.5 ab	117.1 a-c	68.25 ab	150.50 a	132.50 a-c	134.50 ab
16	120+30 Tri.	144.6 a-c	114.3 a-d	68.25 ab	143.00 ab	145.00 a	131.25 ab

Means designated by the same letter(s) are not significant at the 0.05 level according to Duncan's multiple range test.

Stem diameter (cm):

It seems that high nitrogen, phosphorus levels and the sources of phosphorus did not have a remarkable effect on stem diameter, except in few cases where it had significant differences relative to the rest of treatments (Table 4).

Leaf/stem ratio, (fresh and dry):

Data presented in Tables (5 and 6) revealed that application with 120 kg N + 15 kg P_2O_5 monocalcium phosphate gave the highest leaf/stem ratio, (fresh and dry) at all cuts during the two seasons except at first cut in 1996 for fresh and dry leaf/stem ratio without significant differences with the last three treatments (treatments 14, 15 and 16) in most cases.

Table (4): Effect of different levels of N and different sources and rates of P on stem diameter.

Treatments		1996			1997		
		1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
	N P						
1	0	0.70 gh	0.93 b	0.79 c-d	0.90 c	1.20 b	1.00 a
2	60	0.86 a-c	0.91 b	0.81 cd	0.93 bc	1.33 ab	1.05 a
3	90	0.76 eg	0.98 ab	0.92 ab	1.05 ac	1.20 b	1.10 a
4	120	0.82 bd	0.88 b	0.91 ab	0.95 a-c	1.27 ab	1.05 a
5	60 +15 Mono.	0.70 gh	0.87 b	0.86 a-d	1.05 a-c	1.35 ab	1.13 a
6	60 +15 Tri.	0.68 h	0.99 b	0.79 c-d	0.93 bc	1.33 ab	1.10 a
7	60 +30 Mono.	0.84 ad	0.99 ab	0.83 b-d	0.98 a-c	1.33 ab	1.08 a
8	60 +30 Tri.	0.71 oh	0.94 b	0.89 a-c	1.00 a-c	1.40 a	1.13 a
9	90 + 15 Mono.	0.78 d-f	0.96 ab	0.89 a-c	1.08 ab	1.42 a	1.15 a
10	90 +15 Tri.	0.84 a-d	0.88 b	0.93 a-b	1.00 a-c	1.33 ab	1.02 a
11	90 + 30 Mono.	0.81 ce	0.90 b	0.84 a-d	0.98 a-c	1.25 ab	1.13 a
12	90 +30 Tri.	0.84 a-d	0.94 b	0.89 ad	1.00 a-c	1.25 ab	1.17 a
13	120 + 15 Mono.	0.90 a	1.15 a	0.94 a	1.10 a	1.40 a	1.15 a
14	120+ 15 Tri.	0.74 f-h	0.96 ab	0.90 ac	0.95 a-c	1.30 ab	1.05 a
15	120 + 30 Mono.	0.88 ab	0.97 ab	0.85 a-d	1.08 ab	1.38 ab	1.02 a
16	120+30 Tri.	0.84 ad	0.96 ab	0.88 a-d	10.00 ac	1.38 ab	1.10 a

Means designated by the same letter(s) are not significant at the 0.05 level according to Duncan's multiple range test.

Table (5): Effect of different levels of N and different sources and rates of P on fresh leaf/stem ratio (%).

Treatments		1996			1997		
		1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
	N P						
1	0	24.20 d	29.23 h	44.88 d	26.20 d	31.97 f	32.30 e
2	60	34.63 a-b	36.65 bj	57.80 bc	29.95 b-d	38.55 cd	36.00 b-d
3	90	31.05 a-c	36.30 c-h	54.85 cd	28.08 b-d	31.65 f	35.18 b-e
4	120	29.63 a-d	32.47 fh	57.88 bc	28.48 b-d	37.35 de	34.50 c-e
5	60 +15 Mono.	26.13 c-d	37.20 b-f	55.60 cd	27.10 cd	37.78 ce	34.67 c-e
6	60 +15 Tri.	30.70 ac	33.90 e-h	59.53 bc	32.33 b	42.03 bc	35.80 b-d
7	60 +30 Mono.	32.53 a-c	30.00 jh	58.45 bc	27.88 bd	30.55 f	35.00 b-d
8	60 +30 Tri.	32.42 a-c	36.23 d-h	54.45 cd	27.38 cd	33.08 f	36.00 b-d
9	90 + 15 Mono.	29.65 ad	38.35 b-f	58.50 bc	27.10 cd	29.80 f	35.50 b-d
10	90 +15 Tri.	27.85 cd	37.67 b-f	58.00 bc	31.10 bc	38.63 cd	34.28 de
11	90 + 30 Mono.	29.20 a-d	40.17 be	58.85 bc	30.67 b-d	32.58 f	35.00 b-d
12	90 +30 Tri.	28.30 b-d	35.60 d-h	58.20 bc	30.92 bc	33.72 ef	36.10 b-d
13	120 + 15 Mono.	35.22 a	48.03 a	70.93 a	38.40 a	47.10 a	39.88 a
14	120+ 15 Tri.	29.07 a-d	42.18 a-d	60.70 a-c	28.08 b-d	32.72 f	37.55 a-c
15	120 + 30 Mono.	27.55 cd	43.72 ab	61.40 a-c	29.08 b-d	31.88 f	37.17 a-d
16	120+30 Tri.	31.08 a-c	43.38 a-c	64.65 a-c	29.13 b-d	43.45 ab	37.47 a-d

Means designated by the same letter(s) are not significant at the 0.05 level according to Duncan's multiple range test.

Table (6): Effect of different levels of N and different sources and rates of P on dry leaf/stem ratio (%)

Treatments		1996			1997		
		1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
	N P						
1	0	49.90 c	61.25 f	70.57 f	55.60 g	68.95 g	61.63 f
2	60	62.38 a-b	66.50 ef	76.95 ef	58.93 e-g	85.53 b-d	68.80 b-e
3	90	59.35 a-c	73.63 c-f	82.22 c-e	52.5 g	69.88 g	65.10 ef
4	120	61.50 a-c	76.47 b-e	80.07 d-f	690.92 d-f	83.57 ge	65.70 d-f
5	60 +15 Mono.	51.70 bc	76.00 b-e	87.57 b-e	64.68 c-e	72.00 fg	67.88 c-e
6	60 +15 Tri.	57.70 a-c	71.72 df	88.13 b-d	55.90 fg	70.88 fg	70.32 be
7	60 +30 Mono.	62.20 ab	73.00 c-f	84.63 c-e	59.90 d-g	75.82 e-g	66.93 g-e
8	60 +30 Tri.	58.17 a-c	68.32 e-f	85.10 be	63.88 c-f	76.53 eg	71.03 b-d
9	90 + 15 Mono.	50.63 bc	66.57 ef	95.57 b	60.83 d-f	70.35 fg	70.47 b-e
10	90 +15 Tri.	53.28 a-c	76.60 b-e	91.50 bc	63.42 c-f	77.70 d-g	67.55 ce
11	90 + 30 Mono.	54.80 a-c	65.70 ef	81.80 c-e	65.68 b-e	77.00 d-g	71.82 bc
12	90 +30 Tri.	54.80 a-c	70.18 df	81.47 c-e	67.68 b-d	79.13 d-f	69.93 e
13	120 + 15 Mono.	64.78 a	92.80 a	113.4 a	77.22 a	95.55 a	77.72 a
14	120+ 15 Tri.	56.15 a-c	83.50 a-d	86.38 b-e	65.68 be	90.65 a-c	67.28 ce
15	120 + 30 Mono.	58.42 a-c	83.65 a-d	78.53 d-f	70.30 a-c	93.20 ab	67.93 ce
16	120+30 Tri.	58.20 a-c	88.78 ab	108.4 a	73.32 ab	93.70 ab	73.88 ab

Means designated by the same letter(s) are not significant at the 0.05 level according to Duncan's multiple range test.

Fresh forage yield:

Results in Table (7) revealed significant differences among treatments at the three cuts and total yield in both seasons and its combined. In 1996 season, fresh forage yield was higher than in 1997, this may be due to early sowing date in 1996 season. The treatment 120 kg N + 15 kg P_2O_5 monocalcium super phosphate/fad, produced the highest total fresh forage yield in both seasons with no significant differences if compared to teatments 9, 15 and 16 in 1996 and 4 and 15 in 1997. The combined analysis revealed that this treatment gave also the highest total yield over the two sesaons (53.025 ton/fad). Similar results were obtained by Roy (1971), Abdella and Darwish (1972), Fornaworth (1973) and Ghiet *et al.* (1995).

Dry forage yield (ton/fad):

Dry forage yield exhibited approximately the same trend as fresh forage yield in both seasons and also its combined. Meanwhile, this treatment did not differ significantly from treatments 9, 10, 15, 16 in 1996; 4, 9, 15, 16 in 1997 and 15, 16 for the combined total dry yield. It can be concluded that application of 120 kg N + 15 kg P_2O_5 monocalcium phosphate/fad gave the highest dry forage yield (Table 8).

These results are in harmony with those obtained by Plopsoreanu and Cimponeru (1970), Roy (1971), Abdella and Darwish (1972) and Gheit *et al.,* 1995.

Crude protein content:

Data in Table (9) show that treatments 13, 14, 15 and 16 had the highest crude protein values, while control treatment gave the lowest values at all cuts in both seasons.

It can be concluded that with addition of 120 kg N plus 15 kg P_2O_5/fad as monocalcium phosphate to forage sorghum may be recommended to activate the balance between nitrogen and phosphorous.

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Table (9): Effect of different levels of N and different sources and rates of P on crude protein content (%).

Treatments		1996			1997		
		1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
	N P						
1	0	8.2	8.6	9.0	8.4	8.5	8.6
2	60	8.4	8.8	9.1	8.5	8.6	8.6
3	90	8.6	8.9	9.2	8.5	8.8	8.8
4	120	8.9	9.0	9.3	8.8	9.0	9.0
5	60 +15 Mono.	8.5	8.9	9.1	8.5	8.8	9.1
6	60 +15 Tri.	8.4	8.9	9.2	8.7	8.8	8.9
7	60 +30 Mono.	8.9	9.0	9.3	8.8	9.1	9.0
8	60 +30 Tri.	8.7	9.0	9.2	8.6	8.9	9.0
9	90 + 15 Mono.	8.5	8.9	9.3	8.7	9.0	8.9
10	90 +15 Tri.	8.6	9.0	9.3	8.7	9.0	9.0
11	90 + 30 Mono.	8.7	9.1	9.3	8.6	8.9	9.1
12	90 +30 Tri.	8.7	9.0	9.2	8.6	9.0	9.1
13	120 + 15 Mono.	8.9	9.2	9.5	9.0	9.3	9.2
14	120+ 15 Tri.	9.0	9.2	9.5	8.9	9.2	9.2
15	120 + 30 Mono.	9.0	9.2	9.5	8.9	9.2	9.2
16	120+30 Tri.	9.0	9.2	9.5	9.0	9.3	9.2

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تأثير مستويات السماد النيتروجينى وصور ومستويات السماد الفوسفاتى على نمو وكمية محصول العلف فى السورجم ومحتواه من البروتين الخام.

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*** قسم بحوث محاصيل العلف معهد بحوث المحاصيل الحقلية ـ مركز البحوث الزراعية**

**** معهد بحوث الأراضى والمياه والبيئة ـ مركز البحوث الزراعية**

أجريت هذه الدراسة بمحطة البحوث الزراعية بسخا خلال موسمى 1996 ، 1997 لمعرفة تأثير مستويات السماد النيتروجينى (صفر ، 60 ، 90 ، 120كجم نيتروجين/فدان) وصور السماد الفوسفاتى (أحادى وثلاثى) تحت ثلاث مستويات (صفر ، 15 ، 30 كجم فو2أ5/فدان) على نمو وكمية محصول العلف الناتج من هجين سورجم العلف المحلى 102 ومحتواه من البروتين الخام وتأثيره على التوازن بين النيتروجين والفوسفور. زرعت التجربة فى تصميم قطاعات كاملة العشوائية ذات أربع مكررات وتتلخص النتائج فى الآتى:

- وجد أن المستويات المرتفعه من السماد النيتروجينى والفوسفورى أدت إلى تشجيع نمو النباتات وأعطت نباتات أطول.
- كما وجد أن محصول العلف الأخضر والجاف ومحتواه من البروتين الخام يزيد بزيادة مستويات السماد النيتروجينى والفوسفاتى فى كل الحشات فى كلا الموسمين ونسبة الورق/السوق (اخضر وجاف).
- وأن إضافة 120كجم نيتروجين + 15 كجم فو2أ5 آحادى كانت أفضل المعاملات حيث أعطت هذه المعاملة 56.35 ، 49.70 طن/فدان علف أخضر للموسمين 1996، 1997م ، 8.155، 6.642 طن/فدان علف جاف لنفس الموسمين على الترتيب.

Table (7): Effect of different levels of N and different sources and rates of P on fresh forage yield (ton/fad).

Treatment		1996 season			Total	1997 season			Total	Combined
	N.P.	1st cut	2nd cut	3rd cut		1st cut	2nd cut	3rd cut		
1	0	22.050 f	8.925 f	4.375 a	35.350 i	12.950 g	7.910 e	4.900 g	25.760 h	30.555 i
2	60	24.500 ef	14.000 de	5.250 a	43.750 gh	18.375 ef	9.345 d	6.650 df	34.370 g	39.060 h
3	90	26.600 ce	17.500 bc	4.900 a	49.000 df	17.675 ef	12.005 bc	8.575 bc	38.255 ef	43.631 fg
4	120	28.000 bd	17.675 bc	5.250 a	50.925 be	23.800 b	14.525 a	10.150 a	48.475 ab	49.700 b
5	60 +15 Mono.	25.375 de	12.775 e	4.725 a	42.875 h	16.625 f	11.550 bc	6.475 ef	34.650 g	38.766 h
6	60 +15 Tri.	25.900 de	14.000 de	4.550 a	44.450 gh	19.075 de	9.240 d	7.175 ef	35.490 fg	39.970 h
7	60 +30 Mono.	26.600 ce	16.800 bc	4.375 a	47.775 eg	19.950 de	11.025 c	6.475 ef	37.450 fg	42.616 g
8	60 +30 Tri.	25.200 df	15.400 cd	5.075 a	45.675 fh	17.675 ef	9.870 d	6.650 df	34.195 g	39.935 h
9	90 + 15 Mono.	31.150 ab	18.200 ab	5.075 a	54.425 ab	18.025 ef	12.180 b	8.050 bd	38.255 ef	46.340 ce
10	90 +15 Tri.	29.575 ac	16.975 bc	5.075 a	51.625 be	19.425 de	11.655 bc	6.300 fg	37.380 fg	44.506 eg
11	90 + 30 Mono.	29.925 ab	16.800 bc	4.725 a	51.450 be	21.000 cd	12.250 b	7.875 be	41.125 de	46.291 ce
12	90 +30 Tri.	29.225 ac	15.400 cd	5.075 a	49.700 cf	23.975 b	11.795 bc	6.650 df	42.420 d	46.060 df
13	120 + 15 Mono.	31.325 a	20.650 a	4.375 a	56.350 a	26.775 a	14.525 a	8.400 bc	49.700 a	53.025 a
14	120+ 15 Tri.	29.925 ab	16.625 bc	5.075 a	51.625 be	23.450 b	14.175 a	8.400 bc	46.025 bc	48.825 bc
15	120 + 30 Mono.	30.625 ab	17.150 bc	4.900 a	52.675 ad	23.100 bc	14.595 a	8.925 ab	46.620 ac	49.651 b
16	120+30 Tri.	31.675 a	16.800 bc	5.250 a	53.725 ac	23.275 bc	12.040 b	8.050 bd	43.365 cd	48.545 bd

Means designated by the same letter(s) are not significant at the 0.05 level according to Duncan's multiple range test.

Table (8): Effect of different levels of N and different sources and rates of P on dry forage yield (ton/fad).

Treatment		1996 season			Total	1997 season			Total	Combined
	N. P.	1st cut	2nd cut	3rd cut		1st cut	2nd cut	3rd cut		
1	0	3.176 h	1.205 g	0.822 ce	5.204 g	1.996 h	1.031 e	0.803 e	3.830 i	4.516 h
2	60	3.726 eg	1.789 f	0.833 be	6.348 ef	2.160 gh	1.213 de	1.189 ae	4.562 hi	5.455 fg
3	90	3.868 dg	2.225 ce	0.731 de	6.823 de	2.458 dg	1.583 ad	1.465 ac	5.506 cg	6.164 de
4	120	3.815 eg	2.265 be	0.797 ce	6.876 de	2.853 cd	1.932 a	1.534 a	6.320 ac	6.598 cd
5	60 +15 Mono.	3.448 gh	1.778 f	0.790 ce	6.016 f	2.302 fh	1.448 cd	1.051 ce	4.801 gh	5.409 fg
6	60 +15 Tri.	3.571 fh	1.796 f	0.711 de	6.079 f	2.367 eh	1.197 de	1.061 ce	2.624 hi	5.351 g
7	60 +30 Mono.	4.048 ce	2.209 de	0.655 e	6.913 de	2.980 bc	1.665 ac	1.091 be	5.735 bf	6.324 ce
8	60 +30 Tri.	3.995 ef	2.037 ef	0.846 be	6.878 de	2.561 cg	1.236 de	1.144 ae	4.941 fh	5.909 ef
9	90 + 15 Mono.	4.339 ac	2.447 ad	0.923 ae	7.707 ac	2.797 ce	1.526 bd	1.530 ab	5.852 ac	6.780 bc
10	90 +15 Tri.	4.178 ae	2.503 ac	1.108 ab	7.791 ac	2.661 cf	1.492 bd	1.171 ae	5.324 eh	6.556 cd
11	90 + 30 Mono.	4.177 ae	2.458 ad	0.925 ae	7.560 bc	2.864 cd	1.560 ad	1.314 ad	5.739 be	6.649 cd
12	90 +30 Tri.	4.105 be	2.538 ab	0.946ad	7.588 bc	2.917 bc	1.559 ad	0.998 de	5.473 dg	6.531 cd
13	120 + 15 Mono.	4.304 ad	2.664 a	1.191 a	8.155 ab	3.359 ab	1.852 ab	1.432 ad	6.642 a	7.399 a
14	120+ 15 Tri.	4.06 ce	2.423 ad	0.827 be	7.308 cd	2.694 cf	1.721 ac	1.355 ad	5.770 bc	6.540 cd
15	120 + 30 Mono.	4.539 ab	2.556 a	1.048 ac	8.141 ab	2.959 bc	1.872 ab	1.460 ac	6.291 ad	7.217 ab
16	120+30 Tri.	4.612 a	2.440 ad	1.206 a	8.260 a	3.525 a	1.577 ad	1.266 ad	6.368 ab	7.315 a

Means designated by the same letter(s) are not significant at the 0.05 level according to Duncan's multiple range test.