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EFFECT OF MINERAL FERTILIZATION AND CUTTING NUMBERS ON GROWTH AND PRODUCTIVITY OF GUAR PLANT II. EFFECT ON YIELD OF GREEN FOLIAGE, SEED, GUARAN YIELD AND PROTEIN

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ABSTRACT: This work was carried out during the two successive growing seasons of 2019 and 2020 at the farm of Animal Industrial Feeding Factory, Shosha Village, which belongs to Production Sector, Agricultural Research Centre, Ministry of Agriculture, and Laboratory of Floriculture, Faculty of Agriculture, Minia University, to study the effect of NPK fertilization and number of cuts on the foliage, seed and guaran yield as well as protein content of guar (*Cyamopsis tetragonoloba*, L. Taub.) plant. Data revealed that increasing mineral NPK level led to significant increase all studied parameters (fresh and dry green foliage/fed/year, seed and guaran yield/plant and /fed/year and protein content) comparing with control. The results showed that increasing number of cuts significantly increased fresh and dry green foliage/fed/year and, protein content while significantly decreased seed and guaran yield/plant and /fed as compared with non-cut plants. The interaction treatment of high level of NPK in combination with three cuts was the best interaction treatment to obtain the highest green foliage/plant and /fed/year and protein content. For obtaining good productivity of seeds and guaran, it should be fertilizing plants with a high level of NPK (200:200:100 kg/fed) without cutting. Meanwhile, when green leaf yield is the primary goal, it is suggested to supply plants with the high level of NPK (200:200:100 kg/fed) and cutting plants three times. In the case of search for a good yield of seed, guaran and foliage, it could be recommended to fertilize guar plants with the high level of NPK and cutting plants just one time.

Key words: *Cyamopsis tetragonoloba*, fertilization, NPK, number of cuts, yield, green foliage, protein.

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INTRODUCTION

Guar plant, *Cyamopsis tetragonoloba* (L.) Taub. belongs to Fabacea Family (Leguminaceae) (Gillet, 1958), is a summer legume traditionally grown in the semi-arid regions of India and Pakistan as a vegetable, forage and grain crop.

Many workers concluded that mineral fertilization treatments significantly increased yield production of guaran plants such as Meawad *et al*. (1991), Omar (1996), Badran *et al*. (2001), Mohamed (2009), Ayub *et al*. (2011), Gendy *et al*. (2013) and Mahdy and El-Said (2017).

Total yield of foliage fresh and dry weights/plant and /fed/year were increased due to increasing the number of cuts. However, number of cuts led to decrease the number of pods/plant, number of seeds/5 pods, seed yield/plant and /fed and weight of 1000 seeds compared to control in both seasons, except for the treatment of one cut which enhanced all the previous characters and resulted in the highest values as

mentioned by Omer *et al*. (1993) on guar, Moniruzzaman *et al*. (2008) on kangkong plant and Moniruzzaman and Rahman (2015) on coriander.

Therefore, the aim of this study was to evaluate the effect of mineral fertilization and cutting frequency on green foliage, seed, protein and guaran productivity of *Cyamopsis tetragonoloba* L. Taub. guar plants.

MATERIALS AND METHODS

This work was carried out during the two successive growing seasons of 2019 and 2020 at the farm of Animal Industrial Feeding Factory, Shosha Village, which belongs to Production Sector, Agricultural Research Centre, Ministry of Agriculture, and Laboratory of Floriculture, Faculty of Agriculture, Minia University, to study the effect of NPK mineral fertilization and number of cuts on the vegetative growth of guar (*Cyamopsis tetragonoloba*, L. Taub.) plants. The experimental treatments were arranged in a randomized complete block design (RBCD) as a split plot design with three replicates. The main plot (A) included four levels of NPK mineral fertilization [$N_0P_0K_0$ (control), $N_1P_1K_1$ (125 kg/fed, 50:50:25), $N_2P_2K_2$ (250 kg/fed, 100:100:50) and $N_3P_3K_3$ (500 kg/fed, 200:200:100)], while the four treatments of number of cuts [CN_0 (without cutting), CN_1 (one cut), CN_2 (two cuts) and CN_3 (three cuts)] occupied the sub-plots. Therefore, the experiment consisted of 16 treatments. The soil physical and chemical analysis were carried out according to the procedure of Jackson (1973) and the obtained data was shown in Table (a).

The seeds of guar plant were obtained from Ornamental Nursery, Faculty of Agriculture, Minia University. The seeds were sown in sandy calcareous soil on March 1st in both seasons. The experimental unit (plot) was 4.8 m^2 (2.0 x 2.4 m) containing 3.0 rows, 50 cm apart and seeds were sown in hills, 30 cm apart on one side of the row, therefore, each plot contained 21 hills and plants were thinned to one plant per hill after three weeks from sowing date. Nitrogen fertilization was in the form of ammonium sulphate (20.6% N), P fertilization was in the form of calcium supper phosphate (15.5% P_2O_5) and K fertilization was in form of potassium sulphate (48.0% K_2O). The amount of P was added during preparation of the soil to cultivation. The amounts of N and K was divided into three equal doses, the first one was applied on April 1st, the second one was on April 15th and the last one was on April 30th. In CN_0, the plants were harvested at the end of the experiment in the 1st week of October, while in CN_1 the plants were cut one time on 15th May, in the case of CN_2, the plants were cut twice on May 15th and July 1st, then CN_3 where, the plants were cut three times on May 15th, July 1st and August 15th. The plants were harvested in the first week of October in both seasons.

Data recorded:

Green foliage/plant (g) and /fed/year (ton), protein (%), seed and guaran yield/plant (g) and /fed/year (kg).

The obtained results were tabulated and statistically analyzed according to MSTAT–C (1986), and LSD test at 5% was followed to compare between the means of the treatments.

RESULTS

Yields of fresh and dry foliage (ton/fed):

Data presented in Table (1) showed that yields of fresh and dry foliage (t/fed) were significantly increased as a result of supplying guar plants with mineral fertilization of $N_1P_1K_1$, $N_2P_2K_2$ and $N_3P_3K_3$ compared with control treatment in both seasons. The heaviest both fresh weight (18.606 and 18.804 t/fed) and dry weight (6.101 and 6.209 t/fed) in both seasons, respectively, were recorded as a result of $N_3P_3K_3$ treatment.

Similar results were reported on guar by Kalra and Khokhar (1979), Meawad *et al*. (1991), Mahdy and El-Said (2017), Abd

Table a. Physical and chemical analysis of the used soil during the two seasons of 2019 and 2020.

Soil character	Values		Soil character	Values	
	2019	2020		2019	2020
Physical properties			**Soluble cations (mg/100 g soil)**		
Sand (%)	91.0	92.0	**Ca^{++}**	8.43	8.61
Silt (%)	6.60	5.80	**Mg^{++}**	1.49	1.57
Clay (%)	2.40	2.20	**Na^{+}**	0.92	1.01
Soil type	Sandy	Sandy	**K^{+}**	0.82	0.89
Chemical properties			**DTPA-Extractable nutrients**		
pH (1:2.5)	8.19	8.29	**Fe (ppm)**	1.07	1.12
E.C. (dS/m)	1.03	1.14	**Cu (ppm)**	0.39	0.42
O.M. (%)	0.05	0.05	**Zn (ppm)**	0.31	0.34
$CaCO_3$ (%)	13.67	13.98	**Mn (ppm)**	0.53	0.59

Allah *et al*. (2020) and Pimonov *et al*. (2021).

Concerning the impact of number of cuts on yields of fresh and dry foliage (t/fed), data presented in Table (1) proved that the effect of number of cuts was significant for yields of fresh and dry foliage (t/fed), as compared to control in both seasons. Therefore, increasing number of cuts led to rising yields of fresh and dry foliage (t/fed). So, the heaviest foliage yield, fresh or dry, (17.814 and 18.013 fresh weight) and (6.102 and 6.171 dry weight) in both seasons, respectively, were obtained from plants of three cuts (CN_3). However, the lowest yields of fresh foliage (12.260 and 12.298 t/fed) and dry weight (2.559 and 3.040 t/fed) in the first and second seasons, respectively, were recorded with the control treatment (without cut). The other treatments (CN_1 and CN_2) gave intermediate values.

Our results are in the line with those emphasized by Abdelsalam and Adar (2019) on guar plant, Omaliko (1980) on elephant and guinea grasses, Coulman and Kielly (1988) and Hejduk (2015) on red clover, Galang *et al*. (1990) on *Sesbania sesban*, Sheaffer *et al*. (1990) on quack grass, Ghandorah *et al*. (1996) and Chen *et al*. (2012) on alfalfa, Akash and Saoub (2000) on Sudan grass, Mukhtar *et al*. (2003) on dwarf and normal napier grasses, Pontes *et al*. (2007) on monocultures of thirteen perennial grass species, Isah *et al*. (2014) on *Moringa oleifera*, Kumar and Chaplot (2015) on sorghum plants and Ansa and Garjila (2019) on elephant grass.

The interaction between the main and sub plots treatments (A x B) was significant for yield of fresh and dry foliage of guar plants in both seasons as clearly shown in Table (1). The heaviest foliage weights, either fresh or dry, were obtained with the high level of NPK (200:200:100 Kg/fed) in combination with three cuttings (CN_3) in both seasons.

Seed yield/plant and/fed:

Data presented in Table (1) revealed that all used treatments of mineral NPK ($N_1P_1K_1$, $N_2P_2K_2$ and $N_3P_3K_3$) significantly increased seed yield/plant and /fed in both seasons. The increase in yield was parallel with the increase in NPK level. So, the highest seed yield/plant (28.95 and 30.25 g) was produced from the treatment of $N_3P_3K_3$ in the two seasons, respectively. Similarly, the highest yield/fed (531.91 and 555.75 kg) was recorded with the treatment of $N_3P_3K_3$ in both seasons, respectively.

In agreement with our results on guar plant were those obtained by Kalra and Khokhar (1979), Singh and Sharma (1982), Razin (1991), Meawad *et al*. (1991), Omar (1996), Tewfike (2000), Omar (2005), Sortino and Gresta (2007), Gendy *et al*. (2013), Kumawat and Mahla (2015), Mahdy and El-Said (2017), Seerangan *et al*. (2019),

Table 1. Effect of mineral fertilization and number of cuts and their interactions on foliage fresh and dry weights/fed (ton) and seed yield/plant and /fed of guar plants during the first and second seasons.

Number of cuts treatments (B)	NPK levels (2:2:1) (Kg/fed) (A)									
	0.0	125	250	500	Mean (B)	0.0	125	250	500	Mean (B)
	The 1st season (2019)					The 2nd season (2020)				
	Fresh foliage (ton/fed)									
Control (Without cut)	6.470	13.230	13.716	15.622	12.260	6.507	13.406	13.892	15.788	12.398
One cut	6.988	14.289	14.814	16.871	13.241	7.028	14.479	15.003	17.051	13.390
Two cuts	7.966	16.289	16.887	19.233	15.094	8.012	16.506	17.103	19.438	15.265
Three cuts	9.400	19.233	19.927	22.696	17.814	9.454	19.477	20.182	22.937	18.013
Mean (A)	7.706	15.760	16.336	18.606		7.750	15.967	16.545	18.804	
L.S.D. at 5%	A: 0.48		B: 0.46	AB: 0.92		A: 0.54		B: 0.52	AB: 1.04	
	Dry foliage (ton/fed)									
Control (Without cut)	1.515	2.023	3.280	3.419	2.559	1.571	3.454	3.511	3.625	3.040
One cut	2.651	3.540	5.740	5.983	4.479	2.666	3.588	5.813	6.047	4.529
Two cuts	3.035	4.054	6.572	6.851	5.128	3.052	4.108	6.656	6.923	5.185
Three cuts	3.612	4.824	7.821	8.152	6.102	3.632	4.891	7.972	8.239	6.171
Mean (A)	2.703	3.610	5.821	6.101		2.730	4.010	5.975	6.209	
L.S.D. at 5%	A: 0.282		B: 0.221	AB: 0.442		A: 0.341		B: 0.281	AB: 0.562	
	Seed yield/plant (g)									
Control (Without cut)	19.58	24.12	28.66	33.64	26.50	19.98	24.64	29.32	34.79	27.85
One cut	20.93	25.08	29.98	34.62	27.65	21.59	26.64	30.97	35.51	28.66
Two cuts	16.87	20.73	23.91	26.02	21.88	17.36	21.36	24.60	29.02	23.09
Three cuts	13.65	16.86	19.48	21.51	17.88	13.74	16.77	19.73	21.66	17.98
Mean (A)	17.76	21.70	25.51	28.95		18.83	22.33	26.16	30.25	
L.S.D at 5%	A: 1.5		B: 0.51	AB: 1.02		A: 0.46		B: 0.4	AB: 0.80	
	Seed yield/fed (kg)									
Control (Without cut)	359.79	443.21	526.63	618.14	486.94	367.13	452.76	538.76	639.27	499.48
One cut	384.59	460.85	550.88	636.14	508.12	196.72	489.51	569.07	652.50	526.95
Two cuts	309.99	380.91	439.35	478.12	402.09	318.99	392.49	452.03	533.24	424.19
Three cuts	250.82	309.80	357.95	395.25	328.46	252.47	308.15	362.54	398.00	330.29
Mean (A)	326.30	398.69	168.70	531.91		333.83	410.73	480.60	555.75	
L.S.D at 5%	A: 40.27		B: 13.11	AB: 26.22		A: 44.21		B: 10.17	AB: 20.34	

Kumar *et al*. (2020) and Pimonov *et al*. (2021).

Concerning the effect of number of cuts on seed yield/plant and /fed, data presented in Table (1) showed that seed yield/plant and /fed significantly differed, where the seed yield/plant and /fed of plants with one cut were significantly increased over all treatments, while the treatments of two or three cuts significantly reduced the seed yield/plant as well as yield /fed comparing with both one cut or without cutting treatments. So, the heaviest seed yield/plant (27.65 and 28.66 g in the first and second seasons, respectively) and yield /fed (508.12 and 526.95 kg in both seasons, respectively) were recorded when plants were cut once.

Our results are in harmony with those mentioned by Omer *et al*. (1993) and Abdelsalam and Adar (2019) on guar plant; Moniruzzaman *et al*. (2008) on kangkong plant; Tehlan and Thakral (2008), Moniruzzaman and Rahman (2015) Abd El-Azim and Waleed (2016), Singh *et al*. (2017) and Bhapkar *et al*. (2019) on coriander; Sarkar *et al*. (2014) on *Ipomoea reptans* and Narayan *et al*. (2018) on palak.

The interactions between the main and sub plot treatments were significant for seed yield/plant and /fed in both seasons as clearly shown in Table (1). The heaviest seed yield/plant and /fed were recorded in plants fertilized with the high level of NPK

(200:200:100 kg/fed) without cutting (CN_0) or cutting once (CN_1) in both seasons.

Guaran productivity:

Data presented in Table (2) revealed that the percentage of guaran, guaran yield (g/plant) and guaran yield (kg/fed) were significantly increased with increasing the level of NPK ($N_1P_1K_1$, $N_2P_2K_2$ and $N_3P_3K_3$) in both seasons. Such increases were parallel with the increase in NPK level. So, the highest values of guaran percentage, guaran yield /plant and /fed were obtained with the high level of NPK (i.e. 200:200:100 kg/fed) in both seasons, while, the lowest ones were obtained with the control treatment ($N_0P_0K_0$). Our results are in harmony with those mentioned on guar plant by Meawad *et al*. (1991), Omar (1996), Badran *et al*. (2001), Mohamed (2009), Ayub *et al*. (2011), Gendy *et al*. (2013) and Mahdy and El-Said (2017).

Referring to the effect of number of cuts on guaran productivity (guaran percentage, guaran yield /plant and /fed), data presented in Table (2), revealed that these three guaran characters were significantly decreased with increasing the number of cuts in both seasons comparing to the control (without cut). Meanwhile, the heaviest values were obtained from the control treatment, contrarily, the lowest values were recorded with plants cut three times (CN_3). The other treatments (one cut and two cuts/season) gave intermediate values. These findings are in harmony with those reported by Omer *et al*. (1993) on guar plant.

The interaction between NPK fertilization and the number of cuts treatments was significant for guaran %, guaran yield /plant and /fed in both seasons as clearly shown in Table (2). The best interaction treatment overall was obtained from plants which received high mineral level of NPK (200:200:100 kg/fed) without cutting.

Protein (%):

Data presented in Table (2) indicated that the protein (%) of guar leaves was significantly increased by increasing mineral fertilization levels ($N_1P_1K_1$, $N_2P_2K_2$ and $N_3P_3K_3$) compared to control treatment in both seasons. The treatment of $N_3P_3K_3$ (200:200:100 kg/fed) resulted the highest protein (%) in the first and second seasons.

Similar results were obtained on guar by Tewfike (2000), Ayub *et al*. (2011) and Gendy *et al*. (2013).

Referring to the effect of number of cuts on guar leaves protein (%), data presented in Table (2) pointed out that the number of cuts had a significant effect on protein content (%) in both seasons compared to the control (without cut). The three cuts treatment (CN_3) was superior than other treatments, followed by twice (CN_2) and then, once cut treatments (CN_1), while without cutting treatment (CN_0) the leaves contained the lowest protein (%) in both seasons.

Similar results were reported by Willms and Beauchemin (1991) on rough *Festuca scabrellavar* and *Danthoiia parryi* grasses; Ghandorah *et al*. (1996), Tabacco *et al*. (2002) and Chen *et al*. (2012) on *Medicago sativa*; Pontes *et al*. (2007) on monocultures of thirteen perennial grass species, Pavlu *et al*. (2011) on Lolio-Cynosuretum grassland and Ibrahim (2017) on *Moringa oleifera*.

The interaction between main and sub plot treatments (A x B) was significant for protein (%) in both seasons. The best interaction treatment was obtained from plants fertilized with the high level of NPK (200:200:100 kg/fed) and cut three times as clearly shown in Table (2).

DISCUSSION

Supplying plants with mineral fertilization [$N_1P_1K_1$ (125 kg/fed, 50:50:25), $N_2P_2K_2$ (250 kg/fed,100:100:50) and $N_3P_3K_3$ (500 kg/fed, 200:200:100)] led to increasing all the studied traits (foliage fresh and dry weights/fed/year and seed yield/plant and /fed) as well as some chemical composition including guaran production and protein content were significantly increased as a result of increasing NPK level. These results

Table 2. Effect of mineral fertilization and number of cuts and their interactions on seed and guaran yield/plant and /fed of guar plants during the first and second seasons.

Number of cuts treatments (B)	NPK levels (2:2:1) (Kg/fed) (A)									
	0.0	125	250	500	Mean (B)	0.0	125	250	500	Mean (B)
	The 1st season (2019)					The 2nd season (2020)				
	Guaran content (%)									
Control (Without cut)	11.41	11.98	12.58	13.21	12.30	11.35	11.92	12.51	12.58	12.09
One cut	10.42	10.64	11.76	11.87	11.17	10.46	10.58	11.69	11.81	11.64
Two cuts	10.11	10.21	10.31	10.42	10.26	10.22	10.34	10.45	10.57	11.40
Three cuts	9.91	10.01	10.11	10.21	10.06	9.66	9.76	10.87	10.98	10.82
Mean (A)	10.46	10.71	11.19	11.43		10.47	10.80	11.38	11.49	
L.S.D. at 5%	A: 0.22		B: 0.18	AB: 0.36		A: 0.11		B: 0.15	AB: 0.30	
	Guaran yield/plant (g)									
Control (Without cut)	2.23	2.89	3.61	4.44	3.29	2.27	2.94	3.67	4.38	3.31
One cut	2.18	2.67	3.53	4.11	3.12	2.26	2.82	3.62	4.19	3.22
Two cuts	1.71	2.12	2.47	2.71	2.25	1.77	2.21	2.57	3.07	2.41
Three cuts	1.35	1.69	1.97	2.20	1.80	1.33	1.64	2.15	2.38	1.87
Mean (A)	1.87	2.34	2.89	3.37		1.91	2.40	3.00	3.50	
L.S.D. at 5%	A: 0.37		B: 0.16	AB: 0.32		A: 0.38		B: 0.11	AB: 0.22	
	Guaran yield/fed (kg)									
Control (Without cut)	41.05	53.10	66.24	81.66	60.51	46.68	53.97	67.40	80.43	60.87
One cut	40.08	49.04	64.79	75.50	57.35	41.49	51.80	66.52	77.07	59.22
Two cuts	31.35	38.90	45.29	49.82	41.34	32.60	40.59	47.24	56.36	44.20
Three cuts	24.86	31.02	36.18	40.37	33.11	24.38	30.08	39.41	43.70	34.39
Mean (A)	34.33	43.02	53.13	61.84		35.04	44.11	55.14	64.39	
L.S.D at 5%	A: 7.34		B: 3.15	AB: 6.30		A: 5.10		B: 1.90	AB: 3.80	
	Protein content (%)									
Control (Without cut)	15.63	15.69	15.81	15.94	15.77	15.69	15.88	16.00	16.13	15.93
One cut	17.50	17.56	17.69	17.81	17.64	18.13	18.25	18.38	18.50	18.32
Two cuts	18.81	18.88	19.19	19.25	19.03	19.56	19.69	19.75	21.75	20.19
Three cuts	21.94	22.38	22.41	22.56	22.30	22.75	23.13	23.19	23.31	24.00
Mean (A)	18.47	18.63	18.75	18.89		19.03	19.24	19.33	19.92	
L.S.D at 5%	A: 0.11		B: 0.10	AB: 0.20		A: 0.09		B: 0.09	AB: 0.18	

could be explained in the line of biological and physiological roles of the three elements (N, P and K) on the previous parameters. The improvement impact of NPK on plant growth and productivity may be due to the role of nitrogen on chlorophyll, enzymes and proteins synthesis; and the role of phosphorus on root growth development, phospho-proteins and phospho-lipids formation as well as the role of potassium on promotion of enzymes activity and enhancing the translocation of assimilates (El-Desuki *et al*., 2006).

From our data, it could be noticed that the improvement in foliage fresh and dry weights/fed/year as a result of increasing cutting number is mainly due to the increase in number of branches/plant. The obvious reason for more leaf yield at more cuttings may be attributed to better vegetative growth of the crop after the previous cutting (Bhapkar *et al*., 2019).

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تأثير التسميد المعدني وعدد مرات الحش علي نمو وإنتاجية نبات الجوار
٢. التأثير علي محصول العلف الأخضر ومحصول البذور والجوران ومحتوي البروتين

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تم إجراء هذه التجارب خلال موسمي النمو المتعاقبين ٢٠١٩ و٢٠٢٠ بمزرعة مصنع أعلاف شوشة التابع لقطاع الإنتاج، مركز البحوث الزراعية، وزارة الزراعة، وأُجريت التحليلات الكيميائية بمعمل شعبة نباتات الزينة، قسم البساتين، كلية الزراعة، جامعة المنيا، مصر لدراسة تأثير التسميد المعدني (النيتروجين والفوسفور والبوتاسيوم) وعدد مرات الحش علي نمو المحصول الأخضر والبذور والجوران ومحتوي البروتين لنبات الجوار (*Cyamopsis tetragonoloba*, L. Taub.). أشارت النتائج إلى أن زيادة مستوي التسميد المعدني (ن فو بو) أدي إلي زيادة معنوية للمحصول الطازج والجاف للعلف الأخضر/فدان/سنة ومحصول البذور/النبات وللفدان والنسبة المئوية للجوران ومحصول الجوران/نبات وللفدان ومحتوي البروتين لنبات الجوار مقارنة بمعاملة الكنترول. وأدت زيادة معاملات الحش (حشة واحدة، حشتين، ثلاث حشات) إلي زيادة معنوية للمحصول الطازج والجاف للعلف الأخضر/فدان/سنة ومحتوي البروتين، ونقص محصول البذور/نبات وللفدان والنسبة المئوية للجوران ومحصول الجوران/نبات وللفدان مقارنة بمعاملة الكنترول (بدون حش). ومعاملة التداخل بين التسميد المعدني بالمستوي الأعلي من النيتروجين والفوسفور والبوتاسيوم بمعدل ٥٠٠ كجم (١:٢:٢) مع الحش ثلاث مرات أعطت أكبر زيادة معنوية للمحصول الطازج والجاف للعلف الأخضر/فدان/سنة ومحتوي البروتين. وبناءً عليه فإنه للحصول علي إنتاجية جيدة لكل من محصول البذور والجوران، يُوصي بتسميد النباتات بالمستوي الأعلي من التسميد المعدني ن فو بو (١:٢:٢) بدون حش النباتات. بينما إذا كان محصول العلف الأخضر هو الأولوية، فيُوصي بتسميد النباتات بالمستوي الأعلي من التسميد المعدني ن فو بو (١:٢:٢) مع الحش ثلاث مرات. و في حالة الجمع بين محصول البذور والجوران والعلف الأخضر، فيُمكن التوصية بتسميد النباتات بالمستوي الأعلي من التسميد المعدني ن فو بو (١:٢:٢) مع الحش مرة واحدة فقط.

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