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The Effects of Nitrogen and Phosphor Fertilizer Applications in Natural Meadows on Botanic Composition and Quality

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Abstract: This study is carried out between 2004-2005 in a natural meadow at Arusu village within the boundaries of Van province to investigate the effects of different doses of nitrogen and phosphate on botanic quality of the meadow and quality of the grass. In this study, which is conducted as three repeating according to factorial trial design in random blocks, nitrogen is applied in 0, 4, 8 and 16 kg da^{-1} doses while, phosphor is in 0, 6 and 12 kg da^{-1} doses. In the 1st year of trial, the effects of nitrogen fertilizer on legume plants are found insignificant while, it is found to be significant on other criterions. In the 2nd year, its effect on all criterions studied is found to be significant. In the 1st year, the highest grain amount is found 4 kg da^{-1} (88.3%); plant amounts belong to other families to be 16 kg da^{-1} (17.3%) and raw protein amount to be 16 kg da^{-1} (11.7%), which is obtained by nitrogen applications. In the 2nd year, the highest legume amount is found to be 27.6%, plant amounts belong to other families to be 16.5% and raw protein amount to be 12.0% in parcels without nitrogen application and in the places with nitrogen application, grain amounts are determined from 16 kg da^{-1} nitrogen application (88.6%). In the 1st year of phosphor fertilizer trial, significant effects are found on plants belong to other families and insignificant effect found on other criterions studied. In the 2nd year of trial, insignificant effects are found on plants belong to other families and significant effects found on other criterions studied. In the year 2004, the highest plant ratio (15.9%) belongs to other families is obtained from parcels without phosphor application. In the 2nd year, the highest legume ratio (24.3%) is get from parcels with 6 kg da^{-1} phosphor application, grain ratio (84.3%) in parcels without phosphor application and raw protein ratio (12.1%) is obtained from parcels with 12 kg da^{-1} phosphor application.

Key words: Meadow, fertilization, nitrogen, phosphor, botanic composition, Turkey

INTRODUCTION

Natural meadow and pasture areas have a great role in animal feeding. Natural meadow and pasture areas that are one of the two qualified roughage sources have lost their power of productivity because of over and early grazing that is present for years. The significant amount of total meadow and pasture areas in Turkey are within the boundaries of Eastern Anatolia region. In Van province, 1,359.072 ha land is meadow and pasture (Van Directorate of the Ministry of Agriculture).

Differently from pastures, meadows are areas used in dry grass production. It is known that winter took a long period like 6 months in Van region. In this period, meadows serve as an indispensable source for supplying dry grass requirements of animals. But as the yield of meadows in Eastern Anatolia region is 300 kg da^{-1} green grass, this ratio is 250 kg da^{-1} in Van province, which is below the regional average (Tahtacioglu *et al*., 1993).

One of the newer-changing care and improvement methods is fertilization. Meadows and pastures are the areas with botanic composition formed by grains, legumes and plants from other families. With the fertilization in these areas, while the developments of some of the plant type are catalyzed that of some other plants are reduced to certain extends (Zabunoglu, 1983). Plant food elements used as fertilizer have considerable effects on productivity, chemical structure of the fertilizer, botanic composition, green forage period and taste of the food (Altin, 1992). Bellido *et al*. (1985) stated that by super phosphate application to natural meadows in Spain, the amount of legumes have increased 7.7%. Krzywy *et al*. (1988) have determined the optimum fertilizer amounts in meadows at Poland as 24 kg N, 5.3 kg P and 15 kg K per decade. In proportional with the increasing fertilizer doses in all trial areas, it is found out that grains increase in floristic compositions while, legumes and plants from other families decrease in the same conditions. Buyukburc and Karagulle (1991) in the study, they have

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carried out in natural meadows at Polatli district of Ankara found out that legume amounts degrees only in nitrogen fertilizer application while, it increase by using nitrogen and phosphate with fertilizer. In a study conducted in Erzurum, it is found out that percent of weight of soar grass and legumes in botanic composition decrease in 5 kg da^{-1} P_2O_5 and 7.5 kg da^{-1}, N applications while, grain ratios increase (Buyukburc *et al*., 1991). In another study conducted in natural meadows in Erzurum plain, while four different doses of nitrogen fertilizer are applied, phosphate is applied in certain amounts like 5 kg da^{-1}. When nitrogen amounts increased, so did the amount of raw protein, but the highest raw protein amounts are obtained from the parcels without nitrogen application (Gokkus, 1989). The reason for this is reported to be the increase of legumes from the parcels without nitrogen. Again, Feyter *et al*. (1985) have applied 0, 2.5, 5.0 and 10.0 kg da^{-1} amounts of nitrogen to the pastures at New Zealand. After the fertilization, they get 5 times of harvest and measured the raw protein ratios of grass in each harvest. In the end of the measurement, they conducted, they have found out that raw protein ratio have risen in first and second harvest when it falls in fourth and fifth ones.

In this study, conducted in meadows of Van region, in which animal breeding is an important source of income, it is aimed at investigating the effects of nitrogen and phosphate in different doses on botanic composition and the quality of the grass obtained.

MATERIALS AND METHODS

This research is carried out in Arisu village within the boundaries of Van province between 2004-2005 years. The trial is constituted as three repeating according to factorial trial design in random blocks. Parcel size is determined as $3\times3 = 9$ m^2, parcel distance 1.5 m and block distance is planned as 2 m. In the study, nitrogen is used in four different doses as 0, 4, 8 and 16 kg da^{-1} while, phosphate is used in three different doses as 0, 6 and 12 kg da^{-1}. In terms of nitrogen source, ammonium nitrate is used, as for phosphor source, triple super phosphate is used. Fertilizer doses are applied into the determined field parcels in every year just after the snow disappeared in spring. In the harvest, randomly chosen $1\times1 = 1$ m^2 area is harvested and grouped as legume, grain and plants from other families. Each group is dried in drying oven at 105°C and botanic composition values are accounted according to dry weights. The rest of the parcels are harvested and dried and raw protein amounts of each parcel is determined by Kjeldahl device. In both years of the research, two harvests are carried out in all parcels.

To the results obtained in the study, variance analysis is applied according to random blocks factorial trying design. The averages in the study conducted are compared according to Duncan multiple comparison test (Duzgunes *et al*., 1987). In the analysis of the statistics, SPSS packet programme is used.

RESULTS AND DISCUSSION

The amount of plants from legume family in botanic composition: Values belong to legume plants in this study, at which effects of nitrogen and phosphor doze applications on botanic composition in natural meadows are investigated in Table 1. The effects of nitrogen and phosphor doses on the ratio of legume plants are found to be insignificant in the 1st year of trial. The legume ratios were between 0.1 and 15.2% in the first harvest and 0.6 and 18.1% in the second harvest at the 1st year of trial.

In the 2nd year of trial, legume ratios were between 3.1 and 31.9% in the first harvest and 1.6 and 37.8% in the second harvest. In the 2nd year of the research, the effect of nitrogen and phosphor doses on legume plants was found to be significant in the ratio of 1%. When average nitrogen doses of both harvests are taken into consideration, the highest amount is found to have obtained from the parcels with no nitrogen application with the ratio of 27.6%. This is followed by 4 kg da^{-1} nitrogen application with the ratio of 22.9%. The lowest legume ratio is found in 16 kg da^{-1} nitrogen application with the ratio of 6.0%. When, we have a look at the average of phosphor doses, the highest legume ratio is found in 6 and 12 kg da^{-1} phosphor applications with the averages as 24.3 and 1.7%, respectively. The lowest legume ratios are obtained from parcels without phosphor application. At the both years of the trial in the averages of two harvests, interaction of nitrogen × phosphor is found to be statistically insignificant.

In accordance with the results obtained in the research, the ratios of legume plants in botanic composition have decreased in increasing amounts of nitrogen doses. An increase is observed in the amount of legumes with phosphor applications. The results bear resemblance with the results found by Buyukburc and Karagulle (1991), Buyukburc *et al*. (1991) and Bellido *et al*. (1985).

The amount of plants from grain family in botanic composition: In the 1st year of the research, the amounts of grains in botanic composition have changed between 64.4 and 91.5% in first harvest, 68.0 and 95.9% in the

Table 1: The effects of nitrogen and phosphor dose applications on legume family plant in botanic composition

		2004					2005				
		Phosphor doses (P)					Phosphor doses (P)				
Harvesting Periods (HP)	Nitrogen doses (N)	P_0	P_6	P_{12}	Average (N×BZ)	Average (N)	P_0	P_6	P_{12}	Average (N×HP)	Average (N)
First harvest	N_0	0.1	0.7	8.9	3.2	-	14.5	28.8	27.4	23.6	-
	N_4	0.2	6.1	7.6	4.6	-	5.9	31.9	30.6	22.8	-
	N_8	6.9	5.5	2.9	5.1	-	3.7	26.1	13.2	14.3	-
	N_{16}	6.3	15.2	13.4	11.6	-	9.4	7.0	3.1	6.5	-
Average (P×HP)		3.4	6.9	8.2	-	-	8.4	23.5	18.6	-	-
Second harvest	N_0	18.1	0.7	7.5	8.8	-	26.2	36.8	31.8	31.6	-
	N_4	2.6	0.5	2.5	1.9	-	9.7	37.8	21.7	23.1	-
	N_8	1.7	5.3	3.7	3.6	-	2.2	15.7	17.2	11.7	-
	N_{16}	0.6	8.4	3.7	4.2	-	1.6	9.9	4.6	5.4	-
Average (P×HP)		5.8	3.7	4.3	-	-	9.9	25.1	18.8	-	-
Average (P×N)	N_0	9.1	0.7	8.2	-	6.0	20.4	32.8	29.6	-	27.6a
	N_4	1.4	3.3	5.1	-	3.3	7.8	34.8	26.1	-	22.9a
	N_8	4.3	5.4	3.3	-	4.4	3.0	20.9	15.2	-	13.0b
	N_{16}	3.5	11.8	8.5	-	7.9	5.5	8.5	3.9	-	6.0b
Average (P)		4.6	5.3	6.3	-	-	9.2b	24.3a	18.7a	-	-

second harvest. In the year 2004, the effects of nitrogen doses on grain plants were statistically significant with the ratio of 5% and the effects of phosphor doses are found to be insignificant. As we have a look at the averages of two harvests, the highest grain percentage is obtained by the application of 4 kg da^{-1} nitrogen with the ratio of 88.3% and it is followed by nitrogen free application and 8 kg da^{-1} nitrogen applications, respectively with the ratios of 85.7 and 84.1%. The lowest amount of grain is obtained from 16 kg da^{-1} nitrogen application (Table 2).

In the 2nd year of the trial, the grain amounts were between 39.0 and 94.2% in the first harvest and 51.9 and 96.1 in the second one. As, we have a look at the averages of two harvests, it is found out that the effect of nitrogen and phosphate doses on grain plants is statistically 1%. The highest grain amounts in the average of two harvests in terms of nitrogen amount is found to be obtained from 16 kg da^{-1} nitrogen application with the ratio of 88.6%. This is followed by 8 kg da^{-1} nitrogen application with the ration of 84.4%. The lowest grain amount is get from the parcels without nitrogen application. Having a glance at the averages of two harvests in terms of phosphor doses shows that the highest grain amount is found in parcels without phosphor with the ratio of 84.4%. The lowest grain amount is detected in 6 kg da^{-1} phosphor application with the ratio of 70.1% this is followed by 12 kg da^{-1} phosphor application with the ratio of 72.0%. In both years of the trial, the effects of nitrogen×phosphor interaction on grain plants are found to be statistically insignificant (Table 2).

When, we have a look at the results obtained from the study, the effectiveness of nitrogen and phosphor fertilizers is not determined clearly in the 1st year while, the effects of fertilizers on botanic composition is apparent from the 2nd year on. Based on increasing doses of nitrogen by the 2nd year, the amounts of grains have increased. Phosphor fertilizer caused the amounts of grains to decrease in botanic composition. The findings of the research are having parallelism with that of Zabunoglu (1983) and Buyukburc *et al.* (1991).

The average of plants belong to other families in botanic composition: In 2004, the amount of plants belong to other families, except for legume and grain families, have shifted between 3.9 and 26.0% in the first harvest and 3.4 and 28.4% in the second one. In the 1st year, the effect of nitrogen and phosphor doses on the average of second harvest is found to be statistically significant in the ratio of 5%. As we have a glance at nitrogen dose applications, the highest amount concerning plants belong to other families is obtained from 16 kg da^{-1} nitrogen application with the ratio of 17.3 and the lowest amounts are obtained from parcels without nitrogen application and 4 kg da^{-1} nitrogen applied parcels with the ratios of 8.3 and 8.4%, respectively. In terms of phosphor doses, the highest amounts are obtained from the parcels without fertilizer application with the ratio of 15.9% and the lowest is found in 4 kg da^{-1} phosphor application with the ratio of 7.5%.

In the 2nd year of the research, the amount of plants belong to other families is found to be shifting between 0.7 and 33.6% in the first harvest and 0.8 and 21.9% in the second one. At 2005, the effects of nitrogen dose applications on both harvest's average is found to be statistically significant with the ratio of 1% while, the effects of phosphor applications are found to be insignificant. The highest amount in different nitrogen dose applications is obtained from the parcels without nitrogen application with the ratio of 16.5%. The lowest ratio is found in 8, 16 and 4 kg da^{-1} nitrogen application with the ratios of 2.7, 5.0 and 6.0%, respectively. In both years of the trial, the effects of nitrogen x phosphor interaction on plants belong to other families are found to be statistically insignificant (Table 3).

Table 2: The percentage of the effects of nitrogen and phosphor dose application on the amounts of legume family plants in botanic composition

		2004					2005				
		Phosphor doses (P)					Phosphor doses (P)				
Harvesting Periods (HP)	Nitrogen doses (N)	P_0	P_6	P_{12}	Average (N×BZ)	Average (N)	P_0	P_6	P_{12}	Average (N×HP)	Average (N)
First harvest	N_0	88.4	91.5	81.3	87.1	-	80.5	55.9	39.0	58.5	-
	N_4	86.6	87.0	88.5	87.4	-	86.8	67.1	64.0	72.6	-
	N_8	76.5	89.8	90.7	85.7	-	94.2	71.9	84.3	83.5	-
	N_{16}	64.4	79.9	73.3	72.6	-	85.3	92.2	92.9	90.1	-
Average (P×HP)		79.0	87.1	83.5	-	-	86.7	71.8	70.0	-	-
Second harvest	N_0	75.8	95.9	81.4	84.4	-	51.9	57.3	62.6	57.3	-
	N_4	87.8	88.7	91.3	89.2	-	88.0	52.1	68.5	69.5	-
	N_8	73.9	84.5	89.3	82.6	-	96.1	77.6	82.1	85.3	-
	N_{16}	79.7	80.2	68.0	76.0	-	92.0	86.4	83.0	87.1	-
Average (P×HP)		79.3	87.3	82.5	-	-	82.0	68.4	74.1	79.3	-
Average (P×N)	N_0	82.1	93.7	81.4	-	85.7a	66.2	56.6	50.8	-	57.9c
	N_4	87.2	87.8	89.9	-	88.3a	87.4	59.6	66.2	-	71.1b
	N_8	75.2	87.2	90.0	-	84.1a	95.1	74.8	83.2	-	84.4a
	N_{16}	72.0	80.1	70.7	-	74.3b	88.7	89.3	87.9	-	88.6a
Average (P)		4.6	79.1	87.2	-	83.0	-	84.3a	70.1b	-	72.0b

Table 3: The effects (%) of nitrogen and phosphor dose applications on plants belong to other families in botanic composition

		2004					2005				
		Phosphor doses (P)					Phosphor doses (P)				
Harvesting Periods (HP)	Nitrogen doses (N)	P_0	P_6	P_{12}	Average (N×BZ)	Average (N)	P_0	P_6	P_{12}	Average (N×HP)	Average (N)
First harvest	N_0	11.5	7.9	9.7	9.7	-	5.0	15.3	33.6	17.9	-
	N_4	13.2	6.9	3.9	8.0	-	7.3	1.0	5.5	4.6	-
	N_8	16.6	4.6	6.4	9.2	-	2.2	2.0	2.6	2.3	-
	N_{16}	26.0	4.9	13.3	14.7	-	5.3	0.7	4.0	3.3	-
Average (P×HP)		16.8	6.1	8.3	-	-	4.9	4.8	11.4	-	-
Second harvest	N_0	6.1	3.4	11.2	6.9	-	21.9	17.6	5.6	15.0	-
	N_4	9.6	10.8	6.3	8.9	-	2.3	10.2	9.8	7.4	-
	N_8	24.4	10.2	6.9	13.9	-	1.8	6.6	0.8	3.1	-
	N_{16}	19.7	11.4	28.4	19.8	-	5.3	3.7	11.0	6.7	-
Ort. (P×BZ)		14.9	8.9	13.2	-	-	7.8	9.5	6.8	-	-
Average (P×HP)	N_0	8.8	5.6	10.4	-	8.3b	13.5	16.4	19.6	-	16.5a
	N_4	11.4	8.9	5.1	-	8.4b	4.8	5.6	7.7	-	6.0b
	N_8	20.5	7.4	6.7	-	11.5ab	2.0	4.3	1.7	-	2.7b
	N_{16}	22.8	8.2	20.8	-	17.3a	5.3	2.2	7.5	-	5.0b
Average (P)		15.9a	7.5 b	10.8ab	-	-	6.4	7.1	9.1	-	-

The amount of raw protein: In the 1st year of trial, the amounts of raw protein have shifted between 7.1 and 1.2% in the first harvest and 6.9 and 12.4% in the second one. In the average of both harvests in the year 2004, the effects of nitrogen doses on raw protein is found to be statistically significant with the ratio of 1% while, the effects of phosphor applications are found to be insignificant. The highest raw protein amount in the average of both harvests in terms of nitrogen doses are obtained from 16 kg da^{-1} nitrogen application with the ratio of 11.7%. This is followed by 8 kg da^{-1} nitrogen application with the ratio of 11.1%. The lowest raw protein amount is obtained from the parcel without nitrogen application and the one with 4 kg da^{-1} nitrogen application with the ratios of 8.5 and 8.7, respectively.

In the 2nd year of the trial, the amount of raw protein is found to be shifting between 9.3 and 13.5% in the first harvest and 10.3 and 13.3% in the second one. In the average of both harvests in the year 2005, the effect of nitrogen doses on raw protein is found to be statistically 5% while, the effects of phosphor applications are found to be significant with the ratio of 1%. As we have a look at nitrogen doses, the highest amount in the averages of both terms is obtained from the parcels without nitrogen application with the ratio of 12.0. The lowest raw protein amount is obtained from 16 kg da^{-1} nitrogen application with the ratio of 11.2%. As for phosphor doses, the highest raw protein amounts are obtained from 12 and 6 kg da^{-1} phosphor applications with the ratios of 12.1 and 11.8%, respectively. The lowest ratio is get from the parcels without phosphor application with the ratio of 11.1% (Table 4).

In accordance with the results of the research, protein amount has increased in the 1st year of trial by fertilization with nitrogen and as for the 2nd year, there is a decline observed in protein amounts by the increasing

Table 4: The effects (%) of raw protein amount on phosphor dose applications

		2004					2005				
		Phosphor doses (P)					Phosphor doses (P)				
Harvesting Periods (HP)	Nitrogen doses (N)	P_0	P_6	P_{12}	Average (N×BZ)	Average (N)	P_0	P_6	P_{12}	Average (N×HP)	Average (N)
First harvest	N_0	7.1	8.9	8.8	8.3	-	9.8	12.0	13.5	11.8	-
	N_4	9.5	9.7	8.3	9.2	-	11.2	11.6	12.4	11.7	-
	N_8	9.9	11.4	11.2	10.8	-	12.3	12.9	11.3	12.1	-
	N_{16}	12.2	11.4	11.9	11.8	-	10.8	10.8	11.0	10.9	-
Average (P×HP)		9.7	10.3	10.1	-	-	11.0	11.8	12.0	-	-
Second harvest	N_0	9.2	6.9	10.4	8.8	-	11.4	11.7	13.3	12.1	-
	N_4	8.2	7.9	8.3	8.2	-	10.3	12.5	11.8	11.6	-
	N_8	11.4	10.4	12.4	11.4	-	11.8	11.4	11.0	11.4	-
	N_{16}	11.5	11.8	11.6	11.6	-	10.9	11.4	12.3	11.5	-
Ort. (P×BZ)		10.1	9.3	10.7	-	-	11.1	11.8	12.1	-	-
Average (P×HP)	N_0	8.2	7.9	9.6	-	8.5 b	10.6	11.8	13.4	-	12.0a
	N_4	8.9	8.8	8.3	-	8.7 b	10.8	12.1	12.1	-	11.6ab
	N_8	10.6	10.9	11.8	-	11.1a	12.0	12.2	11.2	-	11.8ab
	N_{16}	11.9	11.6	11.7	-	11.7a	10.9	11.1	11.7	-	11.2b
Average (P)		9.9	9.8	10.4	-	11.1b	11.8a	12.1a	-	-	-

doses of fertilization with nitrogen. In the 2nd year of trial, in parallel with increasing doses of phosphor, an increase is observed in the amount of raw protein. The findings of the research are in the same line with that of Gokkus (1989) and Feyter *et al.* (1985).

CONCLUSION

In this study at which, the effects of nitrogen and phosphor doses on botanic composition in the natural meadow and the quality of the grass is investigated, it is observed that nitrogen and phosphor doses have significant effects on legumes, grains, plants from different families and raw protein amounts. Especially, from the 2nd year on, the amounts of legume plants have declined and grain plants have increased by increasing amounts of nitrogen doses. In the amount of raw protein, there is a decline observed concordantly with the increasing doses of nitrogen. The reason for this can be explained with the decline at legume family plants concordantly with increasing nitrogen doses in botanic composition. With the increase in phosphor doses, the amount of legume plants have increased but the amount of grains is decreased. An increase is observed in raw protein amounts by the increasing doses of phosphor.

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