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EFFECT OF AMMONIUM PHOSPHATE FERTILIZER ON ALFALFA (MEDICAGO SATIVA) PRODUCTIVITY IN UZBEKISTAN

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Abstract

The article provides results of scientific research on effect of ammonium phosphate fertilizer on productivity of alfalfa in the irrigated conditions of Uzbekistan. It is well known that the fertilization of alfalfa with ammonium phosphate is an important production factor to get high and stable yield in the country. It can be concluded that there is little known about alfalfa yield response to N rates and there is a need to further investigations on alfalfa yield response to N in the irrigated conditions of Uzbekistan.

Keywords: *Alfalfa, ammonium phosphate, fertilizer, irrigated conditions, plant height, and dry forage yield*

Introduction

Alfalfa (Medicago sativa) is an ancient forage crop in Central Asia. The crop is mainly cultivated in the irrigated conditions while in rainfed conditions mainly in mountain areas (350–1500 m above sea level) in Uzbekistan. Young stands of alfalfa usually produce the lowest yield in the first harvest year of alfalfa because the root system is not developed well and is not enough strong to produce long and thick stems. Traditionally alfalfa is not fertilized in the first harvest year in the irrigated conditions of Uzbekistan. A well planned fertilizer application management is necessary for improving forage production alfalfa. Newly seeded alfalfa needs a readily available supply of phosphorus, potassium and other plant nutrients immediately after emergence. In this regard, for the first time in the irrigated conditions of Uzbekistan alfalfa was fertilized in the first harvest year with ammonium phosphate in order to increase yield potential of the crop.

Soil and climatic conditions

This experiment was conducted at the six demonstrations farms of Bukhara district, Uzbekistan. Uzbekistan's soil is moderately eroded dark sierozems, middle loam (topsoil) and heavy loam (lower layers). Organic matter, content of carbonate and pH ranged

from 2.8 to 0.3%, 14.5 to 10.5%, and 7.5 to 8.7 respectively at the 0–5 and 80–100 cm deep profile. Soil – brown carbonate, heavy, large-dusty, medium-and heavily eroded. The humus content in the horizon 0–15 and 15–31 cm is 3.05 and 1.80% and total nitrogen is 0.18 and 0.12%. Phosphorus in the upper layer of the soil is 0.15–0.12%, but mobile forms of phosphorus are only 8.5–5.5 mg / kg of soil. The climate of Uzbekistan is classified as continental with hot summers and cold winters. The climate in the research Farm has a low humidity with hot summer and mild winter. The average summer temperatures is 30°C often surpass 45 °C; the average winter temperature in January is about +1.9 °C, with absolute minimum as low as –30 °C. Uzbekistan experienced the worst winter in 44 years in 2008. Night temperatures ranged from –15 °C to –25 °C for extended periods in January and sometimes in February. The winter in 2007 and 2009 were as usual comparing to long term average temperatures. The winter of 2009 was favorable to the plant growth and development and warmer than usual and almost without snow while in 2008 were recorded heavy snowfalls especially in mountain areas.

Research method

The experiment was laid out in randomized complete block design. Plot size was 25 m^2 (10 × 2.5 m) and replication is fourfold. Total research area was 2400 m^2. The experiment was provided at six farmers' field. There were four treatments, fourth treatment (ammonium phosphate 80 kg ha –1) was added in the second experimental year, and these are as follows: control no fertilizer (AC) and three application rate of Ammonium phosphate at 40 (AC40), 60 (AC60) and 80 (AC80) kg ha –1. First cut was done as of May 15 at the height of alfalfa 75–80 cm, in the beginning stage of flowering, and the cut was done manually at height of 5–7 cm from the ground. Field data for both experiments were collected on plant height, green forage yield and dry forage yield, and economics of fodder produced at market rates were recorded. Data analysis was performed using GenStat program.

Results

The results of this experiment showed that plant height is an important alfalfa trait when different ammonium phosphate application is used for. Analysis of variance in the table 1 shows that significant differences (< .001) between the farms, year and treatment were found in all measurements of first year alfalfa plant height while interaction was not found between treatment and farm (0.154), treatment and year (0.024). Also there was not significant interaction between treatment, farm and year where three factors' interaction was studied (0.984). The analyze show that alfalfa plant height responses to treatment, farm and year were significant (Table 1).

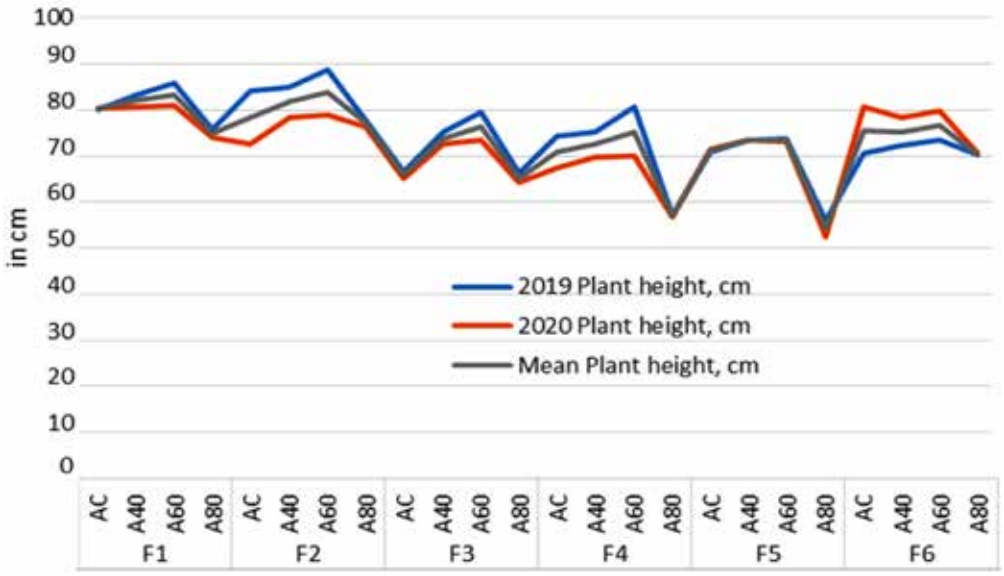
Table 1. *Analysis of variance*

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Treatment	3	1890.00	630.00	49.15	<.001
Farm	5	5336.13	1067.23	83.27	<.001
Year	1	2230.20	2230.20	174.01	<.001
Treatment.Farm	15	270.37	18.02	1.41	0.154
Treatment.Year	2	98.73	49.37	3.85	0.024
Farm.Year	5	2614.30	522.86	40.80	<.001
Treatment.Farm.Year	10	36.22	3.62	0.28	0.984
Residual	126	1614.91	12.82		
Total	167	14090.85			

On the basis of our experiment it was found that the alfalfa crop grew the tallest plant height when the plant is fertilized with ammonium phosphate fertilization rate at 60 kg ha-1 (Figure 1). The highest plant height (88.7 cm) was recorded in 2019 with ammonium phosphate fertilizer rate 60 kg ha –1 in farm 1 while the lowest (52.6 cm) was recorded in 2020 with ammonium phosphate fertilization 80 kg ha –1 in farm 4. Ammonium phosphate fertilization rate at 80 kg ha –1 had shortest height even compare to control treat-

ment where no fertilization was applied. This shows that further increase of fertilizer rate negatively affects plant height of young stands of alfalfa plants in the first growing year.

Figure 1. *Alfalfa plant height as affected by different ammonium phosphate application rate, cm*



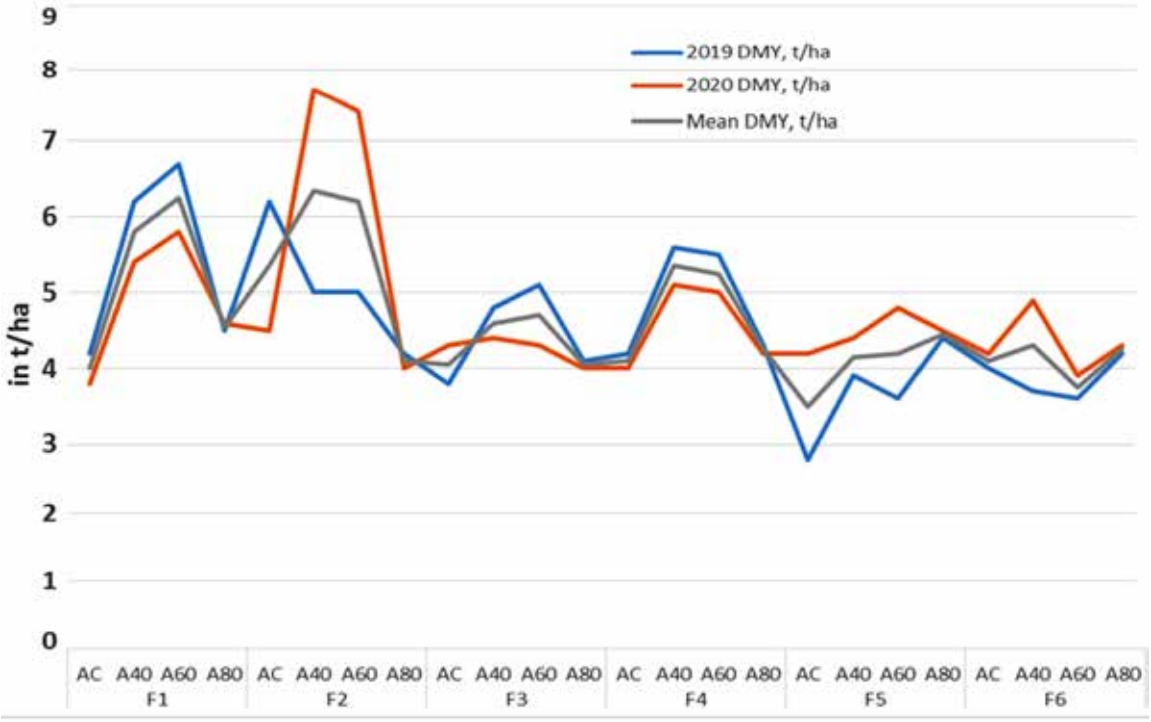
Alfalfa dry forage yield during the entire 2-yr period are reported in Table 2 along with analysis of variance. A significant (< .001) treatment by farm and farm by year interaction was found in dry forage yield. In addition individual treatments, farm and year experienced significant differences (<.001). There was not found any significant difference between treatment by year (0.153) and treatment by farm and year (0.529).

Table 2. *Analysis of variance*

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
T	3	17.4169	5.8056	11.97	<.001
SITE	5	48.1782	9.6356	19.86	<.001
YEAR	1	10.7529	10.7529	22.16	<.001
T.SITE	15	21.4854	1.4324	2.95	<.001
T.YEAR	2	1.8487	0.9243	1.91	0.153
SITE.YEAR	5	57.8505	11.5701	23.85	<.001
T.SITE.YEAR	10	4.4012	0.4401	0.91	0.529
Residual	126	61.1356	0.4852		
Total	167	223.0693			

Dry forage yield was measured at all farms' alfalfa field during the performance of the experiment. Fertilizing alfalfa field with ammonium phosphate resulted in a yield increase each treatment compared to unfertilized alfalfa field. Significant differences among dry forage yield across the fertilization treatments were recorded and the highest yield was obtained when the ammonium phosphate rate was 40 kg ha –1 (Figure 2). It should be mentioned here that dry forage yield between 40 and 60 kg ha –1 ammonium phosphate application rates were not significantly differ. J. Caddel (2003) reports that phosphorus fertilizer can have a negative effect on alfalfa hay production in thinning stands if weeds are not controlled, especially if the phosphorus fertilizer contains nitrogen. In our experiment 80 kg ha –1 of ammonium phosphate fertilizer decreased dry forage yield of alfalfa. This shows that there is no need to further increase fertilizer rate which is negatively affect plant height, green and dry forage productivity of young stands of alfalfa plants in the first growing year.

Figure 2. *Alfalfa dry forage yield as influenced by different ammonium phosphate application rate*



Little is known about alfalfa yield response to N rates. There is a need to further investigations on alfalfa yield response to N in the irrigated conditions of Uzbekistan.

Discussions and Conclusions

The analyze show that alfalfa plant height responses to treatment, farm and year were significant. On the basis of our experiment it was found that the alfalfa crop grew the tallest plant height when the plant is fertilized with ammonium phosphate fertilization rate at 40 kg ha –1. Ammonium phosphate fertilization rate at 80 kg ha –1 had shortest height even compare to control treatment where no fertilization was applied. Analysis of variance shows that alfalfa plant height responses to treatment, farm and year were significant.

A significant (< .001) treatment by farm and farm by year interaction was found in dry forage yield. Significant differences among dry forage yield across the fertilization treatments were recorded and the highest yield was obtained when the ammonium phosphate rate was 60 kg ha –1. Dry forage yield between 40 and 60 kg ha –1 ammonium phosphate application rates were not significantly differ. The fourth treatment (80 kg ha –1) of the experiment has decreased alfalfa plant height subsequently dry forage yield. This shows that there is no need to further increase fertilizer rate which is negatively affect plant height, green and dry forage productivity of young stands of alfalfa plants in the first growing year.

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