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# Raising the Productivity of the Natural Hayfields in the North Part of the Lesser Caucasus

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**Abstract:**

*The article deals with the influence and applying of the mineral fertilizers and also organic and mineral fertilizers to the height, productivity and quality of the irrigated grey-brown hayfields in the north part of the Lesser Caucasus. It has been determined that fertilizers increase the productivity of the hayfields and influence quality indicator and height of the plants.*

**Key words**: The Lesser Caucasus, hayfield, grey-brown, height, organic and mineral fertilizers, dry grass, harvest, quality.

Natural fodder crops territories of the Azerbaijan Republic cover seasonally used summer-winter hayfields and the pastures around the villages that used all the year round.

Areas of natural forage are 3396,4 thousand hectares and it covers 39,3% of the republic territory. 113.4 thousand hectares out of them are hayfields, 1460 thousand hectares are winter pastures, 589,5 hectares are summer pastures, 1233,4 thousand hectares are pastures around the villages. There is 30,6 thousand hectares of hayfields area in the Ganja-Gazakh region.

By the purpose of increasing the productivity of the hayfields and pastures, it is important to take account the botanical composition of the grass cover, also the physical and chemical features of the soil during the fertilization. It is advisable to spread organic fertilizers once in 5 years (about 20 tons of dried manure for each hectare), mineral fertilizers are spread once in 2-3 years (about 1-2 quintals of ammonium celitra, 2-2,5 quintals of superphosphate, 1-1,5 quintal of potassium-chloride for each hectare) [2].

The main sources of existing natural forage in Azerbaijan are natural hayfields. The total area of the natural hayfields is on average 150 000 hectares in our republic. The most parts of them cover highlands, foothills, forest lands, the stripes around the forests and riversides of the Azerbaijan territory. Hayfields develop in some areas, on the slopes, between the shrubberies of semi deserts and sometimes in the damp soils.

It is important to take measures for cleaning the upper layers of the hayfields from weed plants, rocks, harmful and poisonous plants. In the winter pastures one can usually meet unused areas, springs, bogs, lakes and ponds. In order to broaden the pasture areas it is important to drainage these areas and there must be carried out land-reclamation work and use them as the water base [7].

The food matters assimilation of the plants is different during the vegetation process. From this point studying the plants' demand to food matters during the development phase has great scientific-theoretical and practical importance. Studying all these it is possible to define the highest demand to food matter and biochemical role of the some elements. The grass plants mostly assimilate the food elements in the first phase of the vegetation period. Namely from this point of view, it is necessary to provide the grass plants with food matters in early spring. To study the fertilizers norms optimizing influence on the harvest quality and amount of the hayfields of the

Lesser Caucasus, we carried out the experiments in the gray-brown soils of the " Derebagh" area of the Agrocombinat, Goygol region (past the Khanlar region). The experiment is shown in the following scheme:

1. Without fertilizer (supervision); 2. The farm variant (manure 10 t\ha, once in 3 years) 3. $N_{60}P_{60}K_{30}$; 4. $N_{90}P_{90}K_{60}$; 5. $N_{120}P_{120}K_{90}$; 6. Manure 10 t/ha+$P_{35}$; 7. Manure 10 t/ha +$N_{40}P_{65}K_{0}$; 8. Manure10 t/h+$N_{70}P_{95}K_{30}$.

The experience retried 4 times, the area for each variant is 100 $m^2$ and the experiments were carried out by redomization method.

During the experience we used mineral fertilizers nitrogen-ammonium nitrate 34,7%, phosphor-simple superphosphate 18,7% and potassium chloride 57%, humus manure (nitrogen 0,5 %, phosphor 0,25 %,potassium 0,6 %). Every year the manure, the phosphor and potassium fertilizers 100%, nitrogen 50 % are spread in the field in early spring. But the rest 50% of the nitrogen is spread in the field after the first grass cutting.

During the experiment mowing is carried out by the mowing machine, the grass is spread and dried in the field and its dried weight is noted. The agrotechnical measures were fulfilled by the way as they were accepted for the region. To study the agrochemical features of the sites of experience the earth samples were taken in the packets out of 5 different points from the depth of 0-30; 30-60; 60-100 cm and were analyzed before the experience. To determine the amount of food matters and quality indicators of the over ground parts of the grass we took plant samples twice from the site of 1 $m^2$ in 3 points, dried the taken samples in the open air, grinded the taken the average samples and determined the quality indicator and the agrochemical composition.

In the taken earth samples: the PH potentiometer, general humus in the opinion of I.V.Tyurin, the sucked,

ammoniac nitrogen in the opinion of D.P.Konev, nitrate in the opinion of Grandval-Lyaju, the whole nitric, general phosphorus in the opinion of K.E.Ginzburg and G.M.Sheglov, lively phosphorus in the opinion of B.P.Machigin method, general potassium should be seen in the opinion of Smith, metabolism have been appointed potassium flaming photometer in the opinion of P.B.Protasov.

Agrochemical analyses of the areas of experience show that in the grey-brown areas the total amount of the whole humus and the forms of the matters of food that easily assimilated by plants are very few. But in the sowing lay, the pH water solution amount is 7,5, the total humus is 2,38%, the total nitrogen is 0,15%, the total phosphorus is 0,13%, the total potassium is 2,35%. Out of nitrogen composition, the easily swallowed ammoniac nitrogen is 18.55 mg/kg, nitrate nitrogen is10.0 mg/kg, active phosphorus is 17,8 mg/kg, assimilated potassium is 278,3mg\kg. In the layer under soils (30-60; 60-100 cm) the indicators shown above have even diminished greatly.

In the plant samples the absolutely dry substance was determined in 105 ℃ in thermostat, total nitrogen, phosphorus and potassium was determined according to theories by K.E.Ginzburgh, G.M.Sheglov and E.V.Vulfus.

Influence of the fertilizers to the height of the plants has been studied. The carried out phonological observations show that mineral fertilizers, organic and mineral fertilizers together considerably influence to the height of the plants. The results of the investigations have been given in the table.

The height of the plants on all variants was higher in the first mowing and decreased in the fourth mowing. As seen from the table during the first variant (four mowing without fertilizers) the height of the plants was as following: 40.7-43,5; 39,5-41,6; 38,2-40,0; 35,3-37,6 cm; farm variant with manure was about 10 t/ha (once in 3 years) 43,1-45,7; 41,5-43,8; 40,4-41,8; 38,0-39,8 cm.

In the variants where mineral fertilizers were used the highest height of the plants in all mowing $N_{120}P_{120}K_{90}$ variant was 58,0-6,5; 55,0-58,6; 52,3- 56,0; 50,5-53,6 cm. In the variants where mineral fertilizers were used together with manure the highest height of the plants was manure 10 t\ha + $N_{70}$ $P_{95}$ $K_{30}$ variant 56,0-61,5; 53,06-59,5; 50,6-56,8; 48,8-54,0 cm.

So, using the organic and mineral fertilizers in the irrigated gray-brown soils considerably influence to the height of the plants in the hayfields. And the high height means the high amount of harvest. The highest height during the investigation years in the $N_{120}P_{120}K_{90}$ variant in 3 years and the manure equivalent which is observed in the variant of 10 t/ha+$N_{70}P_{95}K_{30}$ cm and height in the mowing was respectively 15,6-17,8; 14,2-17,0; 14,1-16,0; 14,0-16,8 and 15,3-18,0; 13,5-17,9; 12,1-16,8; 13,3-16,4cm. There are a correlative links between the height (cm) and the dry harvest (quintal\ha) and these links have changed as following: in the middle of the IV mowing is p=+0,959+-0,028: p=+0,056+-0,030 and p=+0,948+-0,036.

The large amount of forage reserve is the basic condition for raising the cattle-breading and the animal produce.

In our republic the natural forage reserves form the base of the forage reserve of the cattle-breeding. Therefore, to increase and protect the productivity of the areas of natural forage, to improve the forage quality technologies on scientific-theoretical bases are the main and urgent problems of the present time.

The efficient usage of the hayfields for the development of the cattle-breading and to increase the forage quality, to increase the usage potential condition, to prevent the degradation process of the soils and to solve the other problems of these kinds it is important to regulate the ecological fertility of the soils on the grounds of the ecological fertility models [4].

**Table 1: Influence of fertilizers on the height of the plants in the hayfields**

| | Variants of the experience | 2004 | | | | 2005 | | | | 2006 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I mowing Height cm | II mowing Height cm | III mowing Height cm | IV mowing Height cm | I mowing Height Cm | II mowing Height cm | III mowing Height cm | IV mowing Height cm | I mowing Height Cm | II mowing Height cm | III mowing Height cm | IV mowing Height Cm |
| 1. | Experience without fertilizers | 40,7 | 39,5 | 38,5 | 35,3 | 42,4 | 40,8 | 38,2 | 36,5 | 43,5 | 41,6 | 40,0 | 37,6 |
| 1. | Farm (manure 10 t\ha once in 3 years) | 43,1 | 42,1 | 40,4 | 38,5 | 43,8 | 41,5 | 40,8 | 38,0 | 45,7 | 43,8 | 41,8 | 39,8 |
| 2. | N 60 P 60 K 30 | 46,6 | 45,2 | 43,4 | 40,2 | 45,5 | 43,5 | 42,3 | 39,0 | 48,5 | 46,6 | 44,6 | 41,5 |
| 3. | N 90 P 90 K 60 | 55,9 | 54,4 | 52,7 | 50,4 | 54,6 | 53,2 | 50,5 | 48,3 | 56,0 | 54,5 | 52,4 | 50,8 |
| 4. | N 120 P 120 K 90 | 58,5 | 56,0 | 54,8 | 52,1 | 58,0 | 55,0 | 52,3 | 50,5 | 60,5 | 58,6 | 56,0 | 53,6 |
| 5. | Manure 10t\ha+P35 | 44,4 | 42,8 | 41,0 | 38,0 | 43,5 | 41,5 | 40,8 | 39,8 | 46,8 | 44,3 | 42,3 | 40,1 |
| 6. | Manure 10t\ha+ N40 P65 K0 | 51,2 | 49,4 | 48,0 | 45,3 | 55,0 | 52,3 | 49,5 | 46,5 | 56,8 | 53,0 | 51,3 | |
| 7. | Manure 10t\ha+N70 P95 K30 | 56,0 | 53,0 | 50,6 | 48,8 | 59,3 | 56,5 | 53,4 | 50,8 | 61,5 | 59,5 | 56,8 | 54,0 |

The biological productivity is the integral indicator of the soil-agrochemical and ecological condition of the hayfields and pastures. As a rule, while evaluating the biological productivity material and energy resources (light, temperature, water, guaranty, the amount of the mineral food matters and assimilation, variety of the grass cover etc.) there is used parameters of the natural environment and these resources arrange the productivity condition.

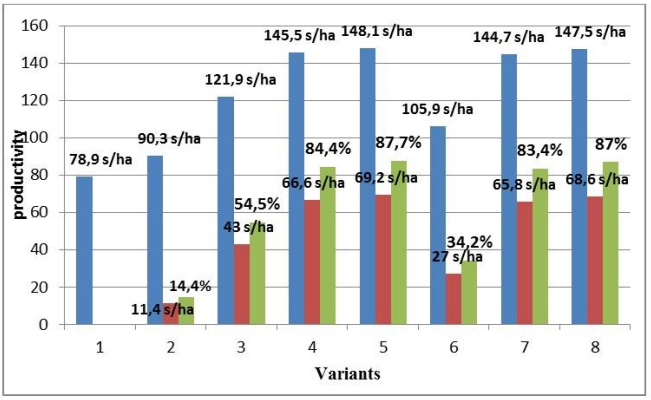
Therefore, it is very actual to study the potential condition of the soils and plant cover in the hayfields and pastures, to pay attention to the intensifying of the productive processes, their connections with the circulation of the food matters, increasing of the biological productivity of the hayfields and pastures, to help for keeping their fitodiversity and long life (by fertilizing and irrigating) are very important issues [6].

In the experiences carried out in the Lesser Caucasus there have been determined that in the gray-brown soils in the north-west slopes, the mineral and organic fertilizers considerably influence on the productivity of the hayfields.

So, the highest amounts of the harvest were in the variants of $N_{90}$ $P_{90}$ $K_{60}$ and manure 10 t\ha +$N_{70}$ $P_{95}$ $K_{30}$. In 3 years the considerable growth of the harvest was on average 148, 1and145,6 quintal/ha and the gained growth was comparatively 65,1- 67,6 quintal/ha or 80,9-84, 0% [5].

Spreading the fertilizers in the hayfields increases the amount of food matters in the over ground parts of the plants,

increases the height of the plants and ensures high productivity in the variant without the fertilizers. Mowing has been carried out 4 times every year and the total harvest schedule of each year has been given the picture. As seen, hay productivity in 5 years, without fertilizers was 78,9 quintal\ha. But in the areas where the manure was used - 10 t\ha, once in 3 years the productivity was 90,3 quintal\ha. In this case the comparative growth is 11,4 quintal\ha or 14,4%.




P=2,20-2,80%, E=2,60-3,20 quintal/ha

Influence of the fertilizers on the productivity of the hayfields

( in 5 years on average, quintal/ha)

1. Without fertilizers, 2. Farm (manure 10 t/ha once in 3 years), 3. $N_{60}P_{60}K_{30}$, 4. $N_{90}P_{90}K_{60}$, 5. $N_{120}P_{120}K_{90}$, 6. Manure 10 t/ha+$P_{35}$, 7. Manure 10 t/ha+$N_{40}P_{65}K_{0}$, 8. Manure 10 t/ha+$N_{70}P_{95}K_{30}$.

Using different norms of the mineral fertilizers in the hayfields has considerably raised the productivity in comparing with the hayfields where the fertilizers were not used.

So, productivity in the $N_{60}P_{60}K_{30}$ variants was 121.9 quintal\ha, the growth there was about 43,0 quintal\ha or 54,5%. In the $N_{90}$ $P_{90}$ $K_{60}$ variant the productivity was 125,5 quintal\ha, 66.6 quintal\ha or 84,4%. The dry hay product in 1 kg NPK was 60,6 kg\ha. In $N_{120}P_{120}K_{90}$ variant the productivity was 148.1; 69,2 quintal\ha or 87,7% and in1kg of the NPK product was 44,8 kg\ha. In the mineral fertilizers + manure

variant, manure 10 t\ha+P35 the productivity was 105,9 quintal\ha, growth in the variant without fertilizers was 27,0 quintal\ha or 34,2%. In manure 10 t\ha+N40 P65 K0 the productivity was 144,7 quintal\ha, 65,8 quintal\ha or 83,4%. Productivity in 1kg NPK was 60,3 kg\ha, the $N_{120}$ $P_{120}$ $K_{90}$ equivalent manure variant 10t\ha+$N_{70}P_{95}K_{30}$ variant 148,5 quintal\ha, 69,6 quintal\ha or 88,2%, in 1 kg NPK productivity was 45kg\ha.

Mathematical calculation of the efficient usage of the fertilizers in the hayfields proves the exactness of the experience (P=2, 20-2 80%, E=2, 60-3, 20 quintal/ha) and growth in the variants is 3 and more times higher than the E, quintal\ha indicator.

So, usage of the mineral and mineral-organic fertilizers in the irrigated hayfields creates strong forage reserve for the cattle-breading.

The high norms of the mineral and organic-mineral fertilizers have not influenced so greatly on the growth of product. For1kg fertilizer the variants of $N_{90}$ P $_{90}$ $K_{60}$ and manure 10 t\ha +$N_{40}$ $P_{65}$ $K_0$ were more efficient.

It is clear that the necessary food matters, including microelements and vitamins for the normal development of the animal organism are found thanks to the natural forage. But plants must appropriate the same elements from the earth. So, it turns out that the number of the food matters in the earth (appropriated by the plants) influence the chemical composition of the forage and it in its turn influence in the what degree the animal organism is provided by these elements. The experiences show that amount of matters in the structure of the forage may differ sharply because of the specific climate, land and other features [1].

Much nitrate nitrogen in the structure of forage is harmful not only for health of the animals but also seriously harmful for the humans as it mixes into the composition of the

milk. At present amount of the nitrate is indicator that shows the biological quality of the forage [3].

Quality of the hayfields changes depending on the period of mowing and the amount of the applied fertilizers. Spreading of the fertilizers in the efficient norms considerably increases the quality of the harvest in the hayfields.

In the variant without fertilizers forage unit in 1ha was 3993,3-4437 and the digested protein was 627,3-697,0 kg/ha. But in the farm variant these indicators are correspondingly 4630,1-5141,7 forage unit and 725,7-807-7 kg\ha.

Under the influence of the mineral fertilizers the dry forage unit in the hayfields and the amount of the digested protein have increased and the forage amount in 1 ha was 6065,6-8352,0; the digested protein amount was about 952,8-1312,0 kg\ha. In the $N_{120}P_{120}K_{90}$ variant the highest forage amount unit was 7605,5-8352,0 and the digested protein amount was 1194,7-1312,0 kg\ha. Under the influence of the mineral fertilizers the forage unit and the digested protein increased about 2072,3-3915,0 forage unit and 325,5-615,0 kg\ha in comparing with the experience variant without fertilizers. The mineral fertilizers' equivalent manure variant 10 t\ha+$P_{35}$ the forage amount unit was 4724,1-5976,9 and the digested protein amount was 742,1-938,9 kg\ha. In the manure used hayfields 10 t\ha+$N_{40}P_{65}K_{o}$ variant the forage amount was 6979,1-8169,3. The highest amount was in the of manure 10 t\ha+$N_{70}$ $P_{95}$ $K_{30}$ variant 7151,4-8586,9 forage unit, or 1123,4-1348,9 kg\ha.

In the variants where we used the organic-mineral fertilizers we got higher amount as 730.8-4149,9 forage unit and amount of the digested protein was 114,8-651,9 kg\ha.

In the variants equivalent to the mineral fertilizers the amount of the nitrates in the mass of the green grass was less in comparing with the mineral fertilizers variant. And it is connected with that the plants get the nitrogen off the manure composition later than off the mineral fertilizers composition.

So, in the manure 10 t/ha+$P_{35}$ variant the nitrate nitrogen amount was as following; in the I mowing 140,6-151,6 mg/kg, IV mowing 123,5-135,5 mg/kg, manure10 t/ha+$N_{40}P_{65}K_0$-da corres[ponded to 148,3-158,4 mg/kg and 132,3-143,2 mg/kg, the highest amount was in the manure 10 t/ha+$N_{70}P_{95}K_{30}$ variant 155,6-165,6 mg/kg and 140,5-151,4 mg/kg. The amount of the nitrate nitrogen has risen in comparing with the first year. It can be explained by increasing the amount of the food matters in the soil where we use mineral fertilizers every year and 50% of the plants in the hayfields consist of clover that takes the nitrogen off the atmosphere. The amount of the nitrates in the green grass mass was less than the proper amount in the forage plants (200 mg/kg in the green mass).

There have been studied the correlative connection between the dry hay and the quality indicators of the albumen, raw protein, nitrate nitrogen and the digested protein.

According to the mathematical calculation the correlative connection between the grass harvest and nitrate nitrogen was as following - r=+0, 661±0, 199. r=+0s, 842±0, 103. r=+0s, 879±0,080 (mg/kg in the wet mass, from about 4 mowing); The correlative connection between grass harvest and raw protein was as following- (dry matter in the open air by %) r=+0, 905± 0.064 r=+0s, 926±0, 050. r=+0s, 962±0,026; The correlative connection between the grass harvest and the digested protein (kg/ha) was as following- r=+0, 998±0, 001. r=+0, 999±0 001 and r=+0, 997±0, 002.

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