

THE INFLUENCE OF COMPOST AND MINERAL FERTILIZERS ON THE CHICK PEA PRODUCTION FROM THE BARREN GANGUE FROM HUSNICIOARA QUARRY IN MEHEDINTI COUNTY

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Abstract: *The soil, the most important component of the biosphere and the main mean of production in agriculture, is destroyed by a range of factors and with this destruction takes place a rupture of some ecological balances between them or between them and the biosphere. Among the factors that destroy the soil are the mine exploitations at surface, having as result empty land which has at their surface rocks from different depths, with essential changes in the natural geomorphology of that area. The attraction of the degraded land in the economic circle; it is necessary to elaborate and to realize the recultivation project for the mine exploiting at surface (this is happening in the same time). Taking into consideration the physical and the chemical qualities which are not suitable for the growth and development of the plants and the low fertility of the barren gangue, the main objective of the biological recultivation was the increase of the content of organic material and nourishing elements which assure the necessary food for the cultivated plants through the use of organic fertilizers like compost, and also the mineral fertilizers with nitrogen and phosphorus. The experience took place in Husnicioara quarry from Mehedinti county on a barren gangue, with a very small content of humus (0.2 – 0.4%) and nourishing elements (nitrogen: 0,08 – 0,16%; phosphorus that can be assimilated 4.5 – 29.9 ppm; potassium 36.5 – 61.4 ppm), and the objectives were: - the effect of different doses of compost and the interval of application on the chick pea crop in the spring; - the effect of different doses of chemical fertilizers on the chick pea crop in the spring. The application of different doses of compost has determined crops that have grown from the unfertilized witness, to the variant which has received the biggest quantity of organic material. The calculus of an average for a period of three years highlighted the value differences between the variants with the witness form 132 to 330 kg/ha, statistically assured in the limit of 0.1%. The research made on the influence of time interval at the application of compost on the chick pea crop have highlighted important differences between witness and the variants with application at 2 and 3 years. The annual fertilization assured the highest value of the production and its constancy, and the application of mineral fertilizers on chick pea crop lead to different crops function of the applied doses.*

Key words: sterile dumps, fertilization, chick pea crop

INTRODUCTION

The problem of ecologic reconstruction of mining sterile became important in our country after 1969, when the mining extended, and the aspect on the environment became obvious.

The directions and methods of recultivation are conditioned by the physical and geographical characteristics of that area, the technology of exploitation, the activity of developing that area, the recultivation being specific for every area.

Using an appropriate recultivation leads to new uses of mining areas or they come back to their old uses.

The physical and chemical properties of barren gangue are a limit for the recultivation process, because of that we have to use plants with little demands for calcium and with high tolerance to acidity and high concentrations of iron, manganese and sulphur (ANGEL, N., PATRICK, 1973).

Naturally, (without nitrogen fertilization) it has to pass many years for the plants to grow on the mining sterile and in order that they can contribute with important quantities to the formation of organic material in the soil, which can stimulate the processes of ammonification and nitrification that are very reduced on the mining fields.

In our country, some specialists have elaborated the problem of organic waste development with a lot of courage and interesting results setting the bases of ecologic fertilization in agriculture. Trying to give back the land from the mining exploitations to the agricultural circle, we experimented the use of organic waste and compost. The presence of chemical fertilizers amplified the efficiency of compost.

The rapid fixation with the help of vegetation (PIHA, M. I., and colab., 1995) and the maintenance of a viable vegetal surface which can reduce the water movement and oxygen in the pit (DANIELS, LEE, W., and colab., 1995) represent an important step in erosion control, in the stabilization and final recultivation of the mining sterile.

MATERIAL AND METHODS

In the quarry from Husnicioara, Mehedinti county, on the psamic four layers entiantrosoil, in the mining sterile, we made an experiment using the method of the divided parcels with three repetitions, which was suitable for the big variation of soil fertility and permitted the calculus and interpretation of results for the polifactorial experiences and also the statistic calculus.

We wanted to know the initial situation of the soil fertility in Husnicioara area, the actual situation of the fertility of the psamic entiantrosoils from the mining sterile, the way of reaction of the materials in the psamic entiantrosoil for different doses of organic fertilizers like compost, the application interval of these and of chemical fertilizers, and their effect on different species of cultivated plants, like chick pea, a vegetable which leaves nitrogen in the soil by fixing it from the atmosphere in the knots from its root system and its main product – the beans – can be sold.

The texture of the protosoil where we made the experiment is represented in the layer 0 – 20 cm through a sandy – clayey texture, and on the profile it becomes clayey – sandy and even clayey – sandy clayey – clayey in the layer 50 - 75 cm.

The reaction of that mining sterile is from weak to moderate alkaline (pH increases from 7,96 to 8,25).

The humus content, very reduced in general, doesn't present any value difference (0,3 – 0,4%) on the section 0 – 150 cm.

As organic fertilizer we used compost, prepared from the waste from cows through supervised fermentation, after a period of 6 months.

The chemical composition of the wet compost (with 39,7% humidity) was: 1.054% N total, 0,447% P₂O₅, 0,095%K₂O, 0,993% CaO și 0,051% Mg, which indicates that the organic material is valuable.

The experiment comprised the following factors:

A factor – the applied compost dose with 4 graduations:

a₁ – unfertilized with compost; a₂ – 10t/ha cow compost; a₃ – 20t/ha cow compost; a₄ – 30t/ha cow compost.

B factor – the time interval regarding the appliance of compost in 3 phases: b₁ – manually applied; b₂ – applied after 2 years; b₃ – applied after 3 years.

C factor – applying mineral fertilizers in 3 phases but with different values of nitrogen and phosphorus: c₁ - N₀ P₀; c₂- N₃₀P₆₀; c₃ - N₆₀P₆₀.

Phosphorus fertilizers were applied every fall (as superphosphorus simple with 20 % P₂O₅), and the compost in the established doses, after this we used the plough and the star

harrow at 20 – 22 cm assuring the mixing of fertilizers and vegetal waste.

Taking into consideration the chemical composition of wet compost, we introduced in the mining sterile the following quantities of elements:

- Annually 10 t/ha = 10,5,4 kg N; 44,7 kg P₂O₅; 9,5 kg K₂O; 18,6 kg CaO and 5,1 kg Mg.

- 20 t/ha = 210,8 kg N; 89,4 kg P₂O₅; 19 kg K₂O; 18,6 kg CaO and 10,2 kg Mg.

- 30 t/ha = 316,2 kg N; 134,1 kg P₂O₅; 28,5 kg K₂O; 27,9 kg CaO and 15,3 kg Mg.

The quantities above were also applied after 2 and 3 years.

Every spring we used the disc harrow which lead to good conditions for sowing.

We used ammonium nitrogen with 33,5% N in separated doses: ½ from the necessary dose was applied at the culture sowing, and the second one after the second manual weeding.

The number of weeding was higher than usual because we didn't apply any herbicide unknowing their effects on such land.

RESULTS AND DISCUSSIONS

The terrain where the experience took place was a mining sterile with a small content of humus and nourishing elements, and in this situation the applied fertilizers were mineral and biological ones with different effects on the chick pea crop during the 3 years of the experiment.

Climate conditions, rain quantities and temperature regime had a special influence.

The results we have obtained regarding the values of the derminations made, for the chick pea crop during the experimentation years, indicated the favourable effect of fertilizers and the time interval when compost was applied.

The application of compost in different doses determined productions that have increased from unfertilized witness to the variant which received the biggest quantity of organic material (table 3).

In the first year the chick pea crop without compost (a₁) was 573 kg/ha.

When we applied 10t/ha we realized 693 kg chick pea, which means 120 kg/ha profit statistically assured in the limit of 1% in comparison with the witness. When the dose doubled (20t/ha) the chick pea crop increased to 771kg/ha with a profit of 198kg/ha, and for the maximum dose (30t/ha), the production reached 878 kg/ha, the profit being of 305 kg/ha, both profits being assured at the limit of 0,1%.

In the second year of the experiment, the chick pea production increased in comparison with the previous year for all the variants with 17 – 54 kg: for the witness (a₁) – 603 kg/ha; for 10t/ha compost (a₂) - 747 kg/ha; for 20t/ha- 788 kg/ha andfor 30t/ha - 922 kg/ha. The profits realized for the variants which received organic material were different and significant.

The last year of the experiment registred chick pea productions aproximatelly as the previous year with differences between the unfertilized variant and the variant fertilized with compost from 131 to 365 kg/ha.

The calculus of the averages for a period of three years highlighted differences between variants in comparison with the witness from 132 to 330 kg/ha, statistically assured in the limit of 0,1%.

The research made regarding the influence of the time interval when compost was applied on the chick pea crop highlighted important differences between witness (b₁) and the variants with application after 2 years (b₂) and 3 years (b₃) (table 2).

Annual fertilization assured the highest value of production and its constancy.

In the first year, for b₁ variant (annual appliace) we obtained 1040 kg/ha chick pea, in comparison with the other variants b₂ and b₃ which registred only 573 kg/ha meaning 53%.

In the second year, the production differences were smaller between b_1 and b_2 as a following of compost appliance after 2 years (964 and 729 kg/ha) and it maintained higher in comparison with b_3 (964 in comparison with 603 kg/ha).

The results obtained in the last year of experimentation presented close values between the 3 doses used (for the witness we obtained 954 kg/ha), for b_2 – 744 kg/ha, and for the third variant b_3 when we applied compost we realized 814 kg/ha.

The differences of production obtained in minus when we applied compost at 2 and 3 years in comparison with the annual appliance were significant.

The average of the period although it registred different values of production (b_1 – 986; b_2 – 682 and b_3 – 663 kg/ha), statistically calculated presented no semnification, the differences being in the limit of error. This situation was determined by the big variation of chick pea production in the experiment years (used as repetition in the case of variants) especially for b_2 (compost applied at 2 years) and b_3 (applied at 3 years) when we made the statistic calculus for the average of the interval (those 3 years).

Applying mineral fertilization for the chick pea crop lead to obtaining different productions in quantity in comparison with the applied doses (table 3).

When we didn't applied nitrogen or phosphorus we realized 642 kg/ha; for the dose of $N_{30}P_{60}$ the production increased to 736 kg/ha and for $N_{60}P_{60}$ we obtained 808 kg/ha, in the first year of the experiment.

In the second year, the production for all the variants increased moderately reaching for c_1 to 690 kg/ha; for c_2 to 770 kg/ha, and for c_3 to 838 kg/ha.

In the last year we registred bigger productions in comparison with the previous interval, obtaining 708kg/ha for the witness, 798 kg/ha when applying a moderate dose and 850 kg/ha for the dose $N_{60}P_{60}$.

The average of the 3 years presented values of 680kg/ha for N_0P_0 , 768 kg/ha for $N_{30}P_{60}$ and 831 kg/ha for the maximum dose.

As we can see, the differences between the 2 variants minerally fertilized and the witness are significant and very significant statistically speaking.

The increase of production from one year to another for variants (although they are small, up to 50 kg/ha) was determined by the favourable conditions for chick pea crops, and also by the remaining effect of the previous plant (vegetal waste) and the annual fertilizers.

Table 1

The influence of mineral fertilization on the chick pea crop

Applied fertilization	Average of the experimental period			
	Kg/ha	Relative value	Absolute different	Signification
N_0P_0	680	100	0(mt)	-
$N_{30}P_{60}$	768	113	+88	XXX
$N_{60}P_{60}$	831	122	+151	XXX

DL 5% = 17; DL 1% = 28; DL 0.1% = 58

Table 2

The influence of the period of compost application on the chick pea crop

Time period years annual	Average of the experimental period			
	Kg/ha	Relative value	Absolute different	Signification
Annual	986	100	0 (mt)	-
2 years	682	69	- 304	000
3 years	663	67	- 323	000

DL 5% = 703; DL 1% = 1167; DL 0.1% = 2182

The influence of compost fertilization on chick pea crop

Applied fertilization t/ha	Average of the experimental period			
	Kg/ha	Relative value	Absolute different	Signification
Unfertilized	596	100	0 (mt)	-
10	728	122	+132	XXX
20	791	134	+195	XXX
30	926	155	+330	XXX

DL 5% = 41; DL 1% = 51; DL 0.1% = 82

CONCLUSIONS

Taking into consideration the physical and chemical characteristics which are not favourable to the development of plants on mining sterile, the main objective of biological recultivation was the increase of the content of organic material and nourishing elements which can assure the necessary food for the plants, through the use of organic fertilizers like composts and mineral fertilizers having as base nitrogen and phosphorus.

The average production of chick pea for the period of 3 years increased on the surface unity with the progressive application of compost quantities obtaining 596 kg/ha for the unfertilized variant, for the dose of 10 t/ha resulted 728kg/ha, when we used 20 t/ha we obtained 791 kg/ha and for the dose of 30 t/ha we realized 926 kg/ha.

Applying compost on mining sterile after different periods of time determined an average production of 986 kg/ha for annual appliance, it reduced to 682 kg/ha for the period of 2 years and when we applied after a period of three years we obtained 663 kg/ha chick pea.

Applying different doses of chemical fertilizers, the production increased from 680 kg/ha for the unfertilized witness, to 768 kg/ha for the dose of N₃₀P₆₀ and we realized 831 kg/ha when doubling the dose of nitrogen (N₆₀P₆₀).

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