SUMMARY

Key words: ensiled fodder type, crop type, fertilization dose, production, wilting, quality

The current tendency is of intensification of livestock farming, pursuing continuous improvement of quantitative and qualitative performance of products to be offered and on minimum costs and this can be realized mainly based on scientific research. Intensification of meadows can be achieved both through the use of valuable species, varieties highly productive perennial grasses and legumes, by perennial grasses and legumes mixtures, through agro-technical measures and by proper management of meadows. Unlike pure cultures, mixed alfalfa with orchard grass provides more balanced energy-protein feed, while providing the opportunity of ensiling alfalfa in good condition due to the contribution given by orchard grass in soluble carbohydrates. Preservation of alfalfa or alfalfa orchard grass mix as semi-silo or haylage in the form of wrapped bales, could bring much-needed return to the Romanian farms with modest possibilities and especially family type farms, the fodder obtained being, according to literature, higher in quantity and quality to hay.

The purpose of this research was **the capitalization of pure crop alfalfa and mixed with orchard grass as succulent fodder packed in bales**. Objectives and activities are represented by the quantifying the quantitative elements which express the quantitative value with the elements which expresses the qualitative value of fodder at harvest and ensiled of pure alfalfa and of mixture *alfalfa + orchard grass*.

The thesis is divided into **two parts** and **six chapters**.

In the **first part**, which contains 58 pages (25,9% of the thesis), representing Chapters I, II and III, is a study of literature in order to understand the current state of research that relate to improving the technology of growing alfalfa in pure crop and mixed with orchard grass and the fodder conservation technology as bale wrapping in order to obtain a higher quality on resultant fodder.

In the **Chapter I** it`s presented the description of the environment in which it was placed experience in the field. The research was conducted at Ezăreni farm that belongs to Didactic Station of University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad" Iasi and is located in the commune Miroslava, 2.5 km southwest of the city of Iasi in the south-western part of the Moldavian Plain. From the structural point of view, the Moldavian Plain is part of old Moldavian Platform which is nothing but an extension of the Russian Platform in our country. The main existing landforms of commune Miroslava are: hilly plain weak fragmented, Bahlui floodplain, Bahlui and Nicolina terraces, side valleys. Hydrological network is represented by some form of depression that is concentrated routes runoff from large rainfall or snowmelt. The farm is part of the province Ezăreni Dfdx climate (after Koppen's classification) or IIDps (after The Romanian Climate) characterized by boreal climate with cold and frosty winters, with the coldest month temperature below - 33^{o}C and the temperature of the hottest month 25 - 27^{o}C. Aridity index "of Martone" has values of 26-30, in accordance to steppe climate conditions that are due to the influence of the Azores High. The annual average temperature is of 9.6°C, minimum of - 8.1^{o}C, registered in January, and maximum of 28.4°C, achieving in July. Average annual rainfall in the area is about 529 mm on Ezăreni weather station and 517.8 mm on Miroslava weather station, Iasi.

Wettest months are May, June, July and August. Quantitatively reduced precipitation falls in January, February, March, November and December. The soil it's a cambic regradat chernozem and is characterized by a neutral pH - slightly acid in worked layer from the surface, with values ranging from 6.68 to 7.01 pH units. Soil supply with humus, total nitrogen and phosphorus it's medium in the layer 0-30 cm and very good in potassium.

In **Chapter II** are presented the origin, distribution, importance, morphological and technological characteristics of alfalfa (*Medicago sativa* L.) and orchard grass (*Dactylis glomerata* L.).

Chapter III includes research conducted in the country and abroad on the behavior of alfalfa mixed with grasses, alfalfa response to the application of various forms and doses of fertilizers, the how can be preserved the pure alfalfa and in mixture with grass, the chemical composition. It also includes the results of several publications aimed at improving cultivation technology with alfalfa and alfalfa orchard grass mix, respectively, improving conservation

technologies of alfalfa and its mixtures in the form of wrapped bales for a better quality to resultant fodder.

In the second part of the thesis, which comprises 62,5% of the thesis (140 pages) **are presented the results of research regarding the influence of the ensiled fodder type, crop type and dose of fertilizer on productivity and quality of alfalfa.**

Chapter IV presents the purpose, objectives and activities of the study, research material and methods, cultural practices applied and a description of the climate of the experimental period.

In order to achieve objectives was established on the farm Ezăreni of Didactic Station of the University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad" Iasi, in spring 2010, a trifactorial field experience, located by the method of subdivided parcels in three repetitions of the type 2x3x4. For sowing, alfalfa seed has been used in Romanian variety **Magnat** (P = 99%, G = 85%, MMB = 2.1 g) and orchard grass seed of the Danish variety **Ambassador** (P = 95%, G = 94%, MMB = 1.2 g). The activities to achieve each of the objectives proposed have resulted in: determining the yield of dry matter (DM) and crude protein yield (CP) per unit area; determination of the fresh fodder contents in dry matter (DM), in CP, in acid detergent fiber (ADF), neutral detergent-fiber (NDF), calcium (Ca), phosphorus (P), magnesium (Mg) and in crude ash (Ash); determination of the contents and changes in ensiled fodder to the initial fodder in DM, in CP, in ADF, NDF, Ca, P, Mg and in Ash; ensiled fodder pH determination; calculation of quality indicators DMI (dry matter ingestibility), DDM (digestibility of dry matter), RFV (relative feed value); determination of lactic acid, acetic acid and butyric acid in ensiled fodder; calculate the Ca/P ratio, calculation of lactic acid/acetic acid ratio and calculation of the lactic acid proportion in the total acids. All observations, measurements and analyzes were in accordance with experimental techniques and standards.

The data were interpreted statistically by analysis of variance and limit differences calculation. Also, regressions were calculated for correlations between doses of fertilizer and some analyzed parameters and between the content of cell walls and RFV.

From a climate perspective, the experimental period 2009 - 2012 was characterized by higher temperatures to average, they were between 10.4 to 10.8ºC, with 0.2 - 0.8ºC higher than the multiannual average, but with a positive deviation of 1.3 to 2.2°C above the multiannual average during the growing season. Agricultural year 2009 - 2010 was a wetter year, the annual

amount of rainfall is 648.8 mm, 131.0 mm higher than the multiannual average and the amount of rainfall recorded during the growing season (April to September) was 446.0 mm, 108.5 mm higher than the multiannual average of 337.5 mm. Experimental agricultural year 2010 - 2011 recoded an annual rainfall of 507.6 mm, 10.2 mm less than the multiannual average of 517.8 mm. The amount of rainfall recorded during the growing season was 342.8 mm, 5.3 mm greater than the multiannual average of 337.5 mm. Agricultural year 2011 - 2012 was a dry year, the total annual rainfall was only of 355.4 mm, 162.4 mm less than the multiannual average of 517.8 mm. The amount of rainfall recorded during the growing season (April-September) was 245.2 mm by 92.3 mm less than the multiannual average of 337.5 mm.

During the growing season of the agricultural year 2009 - 2010, the driest month was July and had a negative impact on the second production sewing. In the experimental years 2010 - 2011 and 2011 - 2012, only the first sewing received favorable climatic conditions, scythes II, and III were obtained in drought conditions, more pronounced in July and August.

Chapter V presents the results of research on the **influence of crop type and dose of fertilizer on production of DM and the influence of the ensiled fodder type, type of crop and fertilizer dose on the development of DM content as response to wilting and ensiling of pure alfalfa and alfalfa + orchard grass mix.**

In the first experimental year, alfalfa showed greater participation rates in the structure of the mixtures compared to participation proportions set out in sown on all the variants and all sampling cycles. In the II and III experimental years, alfalfa showed higher rates of participation in mixtures structure from those set out in sown on poorly fertilized and unfertilized variants, on harvest cycle I and on the all variants, the following harvest cycles.

The crop of alfalfa mixed with orchard grass productions at cycle I were lower in unfertilized variants, compared with the control (unfertilized pure alfalfa), but thru fertilization, especially with doses of $N_{100}P_{50}$ and $N_{75}P_{50}$ both mixtures of species and in particular the type of crop *alfalfa 75% + 25% orchard grass* showed higher yields of DM even to fertilized variants of pure alfalfa. Cycles II, III and IV, alfalfa pure crop fertilized recorded the highest yields of DM as compared with the crop of mixed species.

Type of crop consists of *alfalfa 75% + 25% orchard grass* recorded a total production (average of the period 2010 to 2012) close to the control (8.26 Mg ha^{-1} DM), which are between 7.99 Mg ha^{-1} DM and 8.38 Mg ha^{-1} DM. The average total DM production recorded on the type

of crop consisting of *alfalfa 50% + 50% orchard grass* ranged from 7.75 Mg ha^{-1}, fertilized and 8.06 Mg ha^{-1}, fertilized with $N_{100}P_{50}$. It was observed in each experimental year, a much smaller proportion of yields from cycles II, III and IV of the total production on the fertilized variants of alfalfa - orchard grass mixtures, compared to pure alfalfa variants.

Among the types of crop, type of crop *alfalfa 50% + 50% orchard grass* showed the greatest loss of moisture by wilting, followed by the type of crop *alfalfa 75% + 25% orchard grass*. After 6 months of storage the ensiled packed bales, there was a decrease in the DM contents recorded on prestorage (before wrapping).

Chapter VI presents the results of research on **the influence of crop type and dose of fertilizer on the amount of crude protein (CP), on the contents in CP, ADF, NDF, hemicellulose (Hemi), Ash, Ca, P, Mg and on the quality indicators DMI, DDM and RFV of fresh fodder**. Also, are presented the results of research on **the influence of the ensiled fodder type, crop type and dose of fertilizer on the evolution of contents in CP, ADF, NDF, hemicellulose (Hemi), Ash, Ca, P, Mg and on the quality indicators DMI, DDM and RFV, and as well on the pH value, on the lactic acid, acetic acid, butyric acid contents of the fodder ensiled in round bales wrapping.**

Mixing alfalfa crop with orchard grass without fertilization decreased both the fresh fodder CP content and the yield of CP, but by fertilization with dose of $N_{75}P_{50}$ and $N_{100}P_{50}$, both mixtures of species showed significant increases compared to control.

Each year, with the exception of 2012, on the cycle I, both the higher content in CP and the highest CP yield were obtained by alfalfa in pure culture fertilized with dose of $N_{100}P_{50}$, followed by the $N_{100}P_{50}$ fertilized variant of the type of crop *alfalfa 75% + 25% orchard grass*.

In 2012, on the cycle I, the highest yield of CP was obtained from fertilized variant with $N_{100}P_{50}$ of type of crop *alfalfa 75% + 25% orchard grass*, followed by $N_{100}P_{50}$ fertilized variant of alfalfa in pure culture. On cycles II, III and IV, both the content in CP and the yield of CP were very significantly smaller in the alfalfa mixed with orchard grass crops, compared to pure crop of alfalfa. The type of crop consisting of *alfalfa 75% + 25% orchard grass* showed an average total yield of CP between 1279 kg ha^{-1} and 1372 kg ha^{-1} (2010 – 2012 period) and it's close to the control (1385 kg ha^{-1}). Total average CP yields recorded on the type of crop consisting of *alfalfa 50% + 50% orchard grass* ranged between 1186 kg ha^{-1}, on unfertilized and 1225 kg ha^{-1}, on fertilized with $N_{100}P_{50}$. Highest losses for the fodder content in CP during

ensiling process, through ensilage in round wrapped bales wrapping, were recorded in pure alfalfa preserved as haylage, ranging from 1.30 (in the variant unfertilized) to 1.64 percentage units (at variant fertilized with a dose of $N_{100}P_{50}$) and respectively, in the form of semi-silo, the loss of between 1.04 (control) to 1.32 percentage units (variant fertilized with a dose of $N_{100}P_{50}$).

The smallest loss of fodder in CP content was recorded on type of crop *alfalfa 50% + 50% orchard grass*, preserved as semi-silo, by 0.29 percentage units, in the variant fertilized with $N_{100}P_{50}$ and 0.47 percentage units, in preservation of the variant fertilized with $N_{75}P_{50}$ in the form of semi-silo and in preservation in the form of haylage of variant fertilized with $N_{100}P_{50}$.

Crop type *alfalfa 50% + 50% orchard grass* showed the highest content in the cell walls of 54.51% NDF, of 40.55% ADF and 13.96% Hemi (on $N_{100}P_{50}$ dose). The lowest values for the content of cell walls in fresh fodder were recorded in the control (unfertilized alfalfa, 39.73% NDF, 31.73% ADF, 8.00% Hemi). The type of crop *alfalfa 75% + 25% orchard grass* values recorded, for fodder content in cell walls, were lower than those of the type of crop *alfalfa 50% + 50% orchard grass* and higher than those of alfalfa in pure culture. Both semi-silo and haylage of the three crops had higher contents in NDF and ADF and lower in Hemi, compared to the initial fresh fodder contents. For the contents of NDF, ADF and Hemi, the values were higher for haylage and lower for semi-silo. In general, the concentration in DM of contents in NDF and ADF of ensiled fodder from the values of fresh fodder, was higher in pure alfalfa and in its fertilized variants and smaller, in the mixtures of species and on unfertilized variants.

Highest reductions for content of Hemi were recorded by semi-silo of *alfalfa 50% + 50% orchard grass* on the fertilized variants with $N_{100}P_{50}$ and $N_{75}P_{50}$ of 0.87 percentage units and 0.98 percentage units respectively, differences from control (0.54 percentage units reduction) is significantly positive.

For the mineral content in fresh fodder, higher values in Ash, Ca and Mg were recorded in pure alfalfa fertilized variants, followed by weaker fertilized variants of the type of crop *alfalfa 75% + 25% orchard grass*. For the content of P, the higher values were recorded in the type of crop *alfalfa 50% + 50% orchard grass*, on the fertilized variants, followed by fertilized variants of the type of crop *alfalfa 75% + 25% orchard grass*. Therefore, the type of crop *alfalfa 75% + 25% orchard grass* was the most balanced in mineral components of the crops. By making the ensiled fodder were recorded losses for the contents in Ca, P and Mg, but small. Mineral contents

in all types of culture, prepared as semi-silo or haylage, optimally meet animal requirements for Ca and it's within the acceptable requirements limits for Mg and P.

Depending on RFV, quality of pure alfalfa fresh fodder ranged from excellent (control, 150 RFV) to good, the variant fertilized with $N_{100}P_{50}$ dose (123 RFV) and for the ensiled fodder, from very good quality (RFV 140 - 138 RFV, the unfertilized variant prepared as semi-silo and haylage) to good quality (114 RFV - 111 RFV, the variant fertilized with $N_{100}P_{50}$). In general, the ensiled fodder of the two mixtures of species, kept the same quality as fresh fodder, very good and good (129 - 101 RFV), on the type of crop *alfalfa 75% + 25% orchard grass* and respectively, good and medium quality (123 - 93 RFV), on the type of crop *alfalfa 50% + 50% orchard grass*.

Butyric acid was present in higher amounts (0.15 to 0.38%) in the semi-silo of all variants of pure alfalfa fertilized. Percentage of participation of lactic acid in total acid was higher in the preparation of semi-silo and haylage from fertilized variants with $N_{100}P_{50}$ and $N_{75}P_{50}$ of the type of crop *alfalfa 50% + 50% orchard grass* (75 - 78%, 76 - 79%). Also, the variants fertilized with $N_{75}P_{50}$ and $N_{100}P_{50}$ of the type of crop *alfalfa 75% + 25% orchard grass*, prepared as semi-silo and haylage have been high in concentrations of lactic acid (71 - 75%, 72 -76% from total acids).

The lowest pH values were recorded in fertilized variants with $N_{100}P_{50}$ and $N_{75}P_{50}$ on semi-silo of type of crop *alfalfa 50% + 50% orchard grass*, of 4.07 and 3.91 respectively, differences from the pH value of the control (4.61) is very significant.

Using a score of ranking DLG scale of ensiled fodders based on the fermentation acids were obtained following marks: semi-silo of pure alfalfa – 90 - 81 points, at low limit for good quality, semi-silo of *alfalfa 75% + 25% orchard grass* - 95 - 100 points, very good quality, semi-silo of *alfalfa 50% + 50% orchard grass* - 100 points, very good quality, pure alfalfa haylage - 90 points, at low limit of very good quality, haylage of *alfalfa 75% + 25% orchard grass* - 95 points, very good quality, haylage of *alfalfa 50% + 50% orchard grass* - 100 points, very good quality.

In the end of thesis are presented the conclusions and recommendations drawn from this study, as well as a selection of references consulted during the completion of this work.