ECOLOGICAL AND ECONOMICAL TECHNOLOGY FOR MECHANIZATION OF GRASSLAND IMPROVEMENT WORKS

TEHNOLOGIE ECOLOGICĂ ŞI ECONOMICĂ DE MECANIZARE A LUCRĂRILOR DE ÎMBUNĂTĂȚIRE A PAJIŞTILOR

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***Abstract*:** *In the paper are presented new technological solutions for mechanization of improving the grassland working, using the special farming machinery: direct drilling machine, sowing machine and a complex aggregate composed by rotary tiller-drill machine and fertilizer equipment. These machines were specially designed and made by Grassland Research and Development Institute Brasov-Romania. The testing results, presented in the second part of the paper, prove the distinct performances of the new technologies, both concerning the agricultural and functional requirements, fuel and work force economy performances. In comparison with usual technologies, the new technologies involves a lower specific fuel consumption with 8.63-25.4 %, a lower work force consumption with 14.63-58.11 % and the minimum passing number of the units.*

Rezumat: *În lucrare sunt prezentate noi soluții tehnologice pentru mecanizarea lucrărilor de îmbunătățire a pajiştilor, utilizând noile maşini agricole speciale: maşina combinată de frezat şi semănat îmbunătățită, maşina specială de semănat plante furajere de pajişti şi agregatele complexe, formate din aceste maşini cu echipamentul de fertilizat. Aceste maşini au fost concepute şi realizate de Institutul de Cercetare-Dezvoltare pentru Pajişti Braşov. Rezultatele încercărilor, prezentate în partea a doua a lucrării, scot în evidență performanțele superioare ale noilor variante tehnologice privitor la respectarea cerințelor agrotehnice şi funcționale, economia de carburanți şi forță de muncă. În comparație cu tehnologia clasică, noile variante tehnologice permit reducerea consumului de carburanți cu 8.63-25.4 %, a forței de muncă necesară cu 14.63-58.11 % cu un număr minim de treceri ale agregatelor.*

Key words: *grassland improvement, special sowing machines, direct drilling machine, complex aggregates, technological solutions*
Cuvinte cheie: *îmbunătățirea pajiştilor, maşină specială de semănat, maşină de frezat şi semănat îmbunătățită, agregate complexe, soluții tehnologice*

INTRODUCTION

The degraded status of the considerably grass area from Romania, that is about 4,9 million hectares, requires the necessity to be improved or maintained in fertile areas with high green mass production using the adequate cultivation technologies. From these technologies, the improvement technologies of degraded pastures by reseeding (total renewing) have an important role, because they permit an increasing of 3-5 times of forage and animal production, in according with biodiversity conservation, the landscape beauty, environment protection and other advantages in concordance with EU rules. The paper presents the results of technological solutions for improvement of degraded grassland using the reseeding method.

MATERIALS AND METHODS

The proposed technologies use the new performing equipments and farming machines: the special grass seeders MSPFP 2.5 type (MOCANU ET AL., 2003 and 2005), the improved grassland rotary tiller- drill machine MCT 2.5M type (HERMENEAN ET AL., 2002), and the frontal fertilizing equipment. Beside the current practice these new agricultural

machines can be used for achievement of high qualitative work performances in accordance with input reducing and a low impact on the environment. The trials of the improvement technology for grassland renovation were carried out in the period 2005-2007, in two stationary area conditions: a degraded pasture with deep fertile soil and deep turf, respectively a degraded pasture with thin fertile soil and deep turf. The field experiments were carried out both during spring and the end summer period (MOCANU V., HERMENEAN I., 2002).

The stationary area conditions of the experiments for degraded grassland with deep fertile soil and deep turf are: type of soil – deep podzols on acid clay dump; humidity of soil, 10-25 cm deep – 25.8%; type of pastures- *Nardus stricta* with *Deschampsia caespitosa*; sown mixture species *Phleum pratense* 35%, *Festuca pratensis* 25%, *Lolium perenne* 10%, *Trifolium pratense* 20%, *Lotus corniculatus* 10%; seeding rate – 36 kg ha^{-1}; fertilising rate – N100 P50 K50.

The stationary area conditions of the experiments for degraded pastures with thin fertile soil and deep turf are: type o f soil – Eutric cambisols on basic sandstone; humidity of soil 5-12 cm deep - 24.2%; type of pasture – *Agrostis tenuis*; sown mixture species: *Dactylis glomerata* 25%, *Festuca pratensis* 15%, *Festuca arundinaceea* 15%, *Lolium perenne* 10%, *Medicago sativa* 15%, *Trifolium pratense* 10%, *Lotus corniculatus* 10%; seeding rate – 38.5 kg ha^{-1}; fertilising rate – N50 P50 K50.

The conditions of the experiments are presented in the table number 1.

Table 1

Conditions of the experiments

Type of grassland	Technology	Period of seeding	Farming machine(*
Degraded with deep fertile soil and deep turf	Usual	spring	u1-u2-u3-u4-u5-u6-u5-u7-u8-u9
		summer – autumn	u1-u2-u10-u3-u4-u5-u6-u5
	New	spring	u1-u2-u4-u12-u7-u8-u9
		summer – autumn	u1-u2-u13-u12
Degraded with thin fertile soil and deep turf	Usual	spring	u1-u11-u11-u3-u5-u6-u5-u7-u8-u9
		summer – autumn	u1-u11-u11-u3-u5-u6-u5
	New	spring	u1-u15-u7-u8-u9
		summer – autumn	u1-u14

(* u1-u14 from the table 1 are following significations:

- u1- Machine for grassland clearing of mole hills and non value vegetation;
- u2 – Reversible plough;
- u3- Centrifugal fertilizer spreader;
- u4-Total soil cultivation equipment;
- u5-Ring roller;
- u6-Universal seed drill;
- u7- Rotary disc mower;
- u8- Rotary tractor-rake;
- u9-Self loading truck;
- u10- Disc harrow;
- u11-Rotary tiller;
- u12- Special grass sowing machine, MSPFP 2,5 type, in aggregate with the frontal carried fertiliser spreader, EF 2,5 type;

- u13 –Power harrow for seedbed preparing;
- u14-Rotary tiller-drill machine, MCT 2,5M type in aggregate with the frontal carried fertiliser spreader, EF 2,5 type.

Each experimental plot carried out in different area conditions and seeding period has 1 ha surface.

RESULTS AND DISCUSSION

The forage yields, during the 2005-2007 period are presented in table number 2. There were 8 combination of type of grassland-seeding period. From each plots have taken 5 samples for determining botanical composition and the dry matter yield.

Table 2

Dry matter yields after grassland improvement

Type of grassland	Technology	Period of seeding	DMY, year [Mg ha^{-1}]	DMY, year [Mg ha^{-1}]	DMY, year [Mg ha^{-1}]
			2005	2006	2007
Degraded with deep fertile soil and deep turf	usual	spring	5.2	8	5.2
		summer-autumn	-	7.96	5.16
	new	spring	5.24	8.12	5.24
		summer-autumn	-	8.1	5.22
Degraded with thin fertile soil and deep turf	usual	spring	4.84	6.82	4.26
		summer-autumn	-	6.68	4.12
	new	spring	4.88	6.9	4.31
		summer-autumn	-	6.74	4.18

The data from the table 2 shows us the dry matter yields are close for different technologies. The relevant differences consist in specific fuel consumption, number of the unit passing and the necessary work force, presented in table 3 and in fig. 1. By analysis of these parameters it results the following: the specific fuel consumption is lower with 8.78 -25.4% for new technologies in comparison with usual technologies; the work force necessary for new technologies is reduced with 14.63 – 58.11% in comparison with usual technologies; the number of unit passing is reduced from maximum 10 passing, for usual improvement technology of grassland with deep fertile soil, during the spring period, up to 2 passing for new improvement technology of grassland with thin fertile soil, the end summer - begin of autumn period.

Table 3

Results of experiments

Type of grassland	Technology	Period of seeding	Fuel consumption [l ha^{-1}]	Work force necessary [man hours ha^{-1}]	Number of unit passing
Degraded with deep fertile soil and deep turf	usual	spring	98.65	12.37	10
		summer –autumn	66.5	9.11	8
	new	spring	89.25	10.56	7
		summer –autumn	60.8	6.76	4
Degraded with thin fertile soil and deep turf	usual	spring	99.4	14.07	10
		summer –autumn	63	10.24	7
	new	spring	83.4	8.12	5
		summer –autumn	47	4.29	2

CONCLUSIONS

According to comparative trials of usual and new technologies of grassland improvement resulted the following conclusions:

- the forage yields of new technologies are quasi closed in comparison with usual technologies;
- promoting new grassland farming equipments and machines e.g. special grass seeding machine MSPFP 2.5 type, rotary tiller-drill improved machine MCT 2.5M type and frontal fertilizer equipment EF 2.5 type, the new technologies are more ecological and economical than usual technologies, because they give the possibility to reduce fuel consumption with 8.63-25.4%, work force consumption with 14.63-58.11% and passing number of the units (from 10 maximum up to 2 minimum);
- the new technologies of grassland improvement can be successfully applied to realise a good combination of yield, forage quality, botanical composition with cost requirements, according with stationary area conditions.

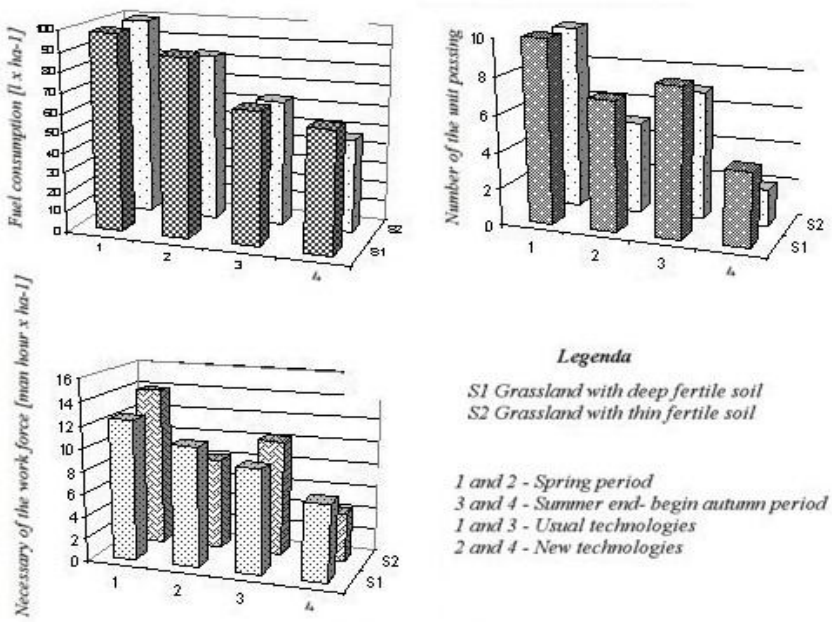

Fig. 1. Variation of determinate parameters

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