NEW MECHANIZATION ALTERNATIVES WITH LOW INPUTS FOR RESEEDING DEGRADED GRASSLANDS

NOI VERIGI TEHNOLOGICE DE MECANIZARE CU INPUTURI REDUSE A LUCRĂRILOR DE ÎMBUNĂTĂȚIRE PRIN REÎNSĂMÂNȚARE A PAJIŞTILOR DEGRADATE

V. MOCANU, I. HERMENEAN

Institutul de Cercetare-Dezvoltare pentru Pajişti Braşov,
Str. Cucului nr. 5 cod 500128, e-mail hermenean.ioan@gmail.com

Abstract: *The paper is well suited for current tendency to promote new technological solutions for mechanization of grassland farming with low input systems. New technological alternatives, at full presented in paper, are focussed on mechanization of reseeding operations for the following degraded pasture types: deep fertile soil and thin sward; deep fertile soil and deep sward, thin fertile soil and deep sward; thin fertile soil and thin sward; affected of erosion. For mechanization of involved operations, the new technological solutions are based on composing of complex aggregates using the current research results from agricultural mechanization. The utilization of the complex farming aggregates provide the realization of 2, 3, 4 or 5 operations by one pass machine, in comparison with usual variants where achieves one operation by one passing. Therefore the new technological solutions of mechanization involve less fuel consumptions, lower necessary labour, a reduced passing number, depending on stationary area conditions and mechanization alternative. Because of these advantages, new mechanization solutions for improvement of degraded grasslands by reseeding method have a low ecological impact, less environment pollution, lower inputs in according with low production costs.*

Rezumat: *Lucrarea este actuală deoarece promovează verigi tehnologice noi de mecanizare cu inputuri reduse a unor lucrări de pe pajişti. Noile verigi tehnologice, prezentate detaliat în lucrare, se referă la mecanizarea lucrărilor de îmbunătăţire prin reînsămânţare a următoarelor tipuri de pajişti degradate: cu strat de sol fertil profund şi cu ţelina subţire; cu strat de sol fertil profund şi cu ţelinã groasã; cu strat de sol fertil subţire şi ţelinã groasã; cu strat de sol fertil subţire şi ţelinã subţire; afectate de eroziune. Pentru mecanizarea lucrărilor necesare, noile verigi tehnologice de mecanizare se bazează pe formarea de agregate complexe folosind, alături de maşinile şi echipamentele specifice, realizări recente ale cercetării din domeniul mecanizării agriculturii. Folosirea agregatelor complexe permite realizare la o singură trecere a 2, 3, 4 sau chiar 5 operaţii, în timp ce la variantele clasice, în general, se execută doar o singură operaţie la o trecere. Ca urmare, în comparaţie cu variantele clasice noile verigi tehnologice de mecanizare necesită consumuri de carburanţi mai reduse, necesar de forţă muncă mai mic si un număr diminuat de treceri ale agregatelor. Datorită acestor avantaje, noile verigi tehnologice de mecanizare au un impact ecologic redus, poluarea mediului (aer, apă, sol) este mai mică, inputurile sunt mai reduse, iar costurile se diminuează proporţional.*

Key words: *variants of mechanization, complex aggregates, reseeding, degraded grasslands*
Cuvinte cheie: *verigi tehnologice de mecanizare, agregate complexe, reînsămânţare, pajişti degradate*

INTRODUCTION

Irrational management of grasslands has led, over time, the degradation through low density or disappearance of valuable species, invasion of non value grass and wood vegetation with mole-hills and erosion. To remove the effects of degradation and restoration of grasslands are needed modern technology to improve and utilise the grasslands. Between them the technology for improving grassland by total renovation has an important role.

Total grassland renovation consists in destroying the old grass sward by total cultivation and replacing it with new vegetation by sowing a grass seed mixture with high forage value. Radical improvement measures (reseeding) are applied on grasslands with an advanced degree of degradation, as well as poor productivity. In the category of degraded grasslands and poor productivity are included: grassland with damaged grass sward; grasslands with low yields (less than 4 $t.ha^{-1}$ green mass); grasslands with low plant density, under 60% degree of coverage; grassland with low forage quality invaded by reduced value forage species and weeds (over 25-30%); grasslands on which the wood vegetation has integral cut off (including stump extracting); the grassland resulted after destruction of large mole-hills and high density per unit area (more than 25 %).

Technology for improving degraded pastures by reseeding requires a lot of operations in the following main groups: works to ensure optimal condition for plant development; seeding itself; works for maintenance of grasslands after reseeding.

In this paper there are presented new variants of mechanization with minimum inputs of some technology operations for improving degraded grasslands by total renovation (reseeding).

The new technological solutions are based on composing and utilization of the complex farming aggregates using with specific equipment and machines, the following recent research results in field of mechanization of grassland farming: fertilizer equipments, EF 2.5 and EF 3.75 type, and improved rotary tiller – drill machine, MCT 2.5 M type.

MATERIALS AND METHODS

To improve the degraded grassland by reseeding, new solutions of mechanization technology used, depending on work conditions, various complex aggregates which provide the realization of 2, 3, 4 or 5 operations by one pass machine, thereby reducing specific fuel consumption , labour and decreasing the number of passes. It is operated by one pass machine as: clearing of non value vegetation and mole-hills and liming operation; total tillage and lime spreading; seedbed preparing and fertilizer spreading; rolling before and after sowing and sowing; destruction of the old sward, seedbed preparing, fodder plant seeding; rolling after sowing and fertilization; fertilization with chemical fertilizers, rolling before and after sowing and sowing of grass fodder plants (MOCANU V., HERMENEAN I., 2008).

Because of the grassland stationary area conditions there are distinguished special situations that affect how to prepare land for seeding, namely:

a. Degraded grasslands with deep layer of fertile topsoil and thin grass sward;
b. Degraded grasslands with deep layer of fertile topsoil and deep grass sward;
c. Degraded grasslands with thin layer of fertile topsoil and deep grass sward;
d. Degraded grasslands with thin layer of fertile topsoil and thin grass sward;
e. Grasslands affected by erosion.

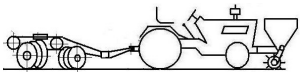
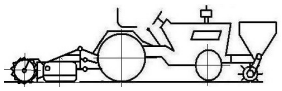
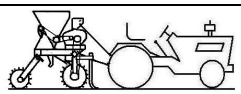
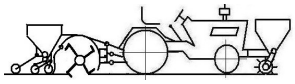
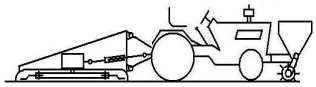
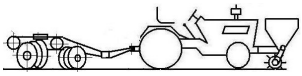
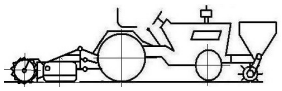
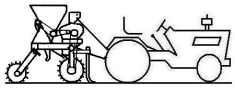
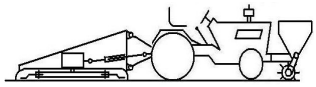
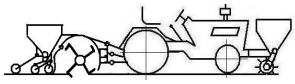
New technological alternatives for mechanization of specific farming works within reseeding technology are presented in Table 1 (MOCANU V., HERMENEAN I., 2008): .

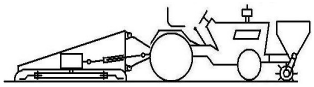
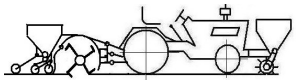
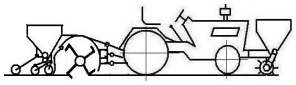
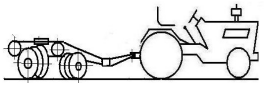
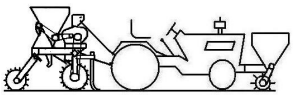
Usual variants of mechanization of works to improve degraded grasslands by reseeding are used simple aggregates achieving one operation by one passing. Usually, depending on the work, are used agricultural machines and equipments suitable to other crops as: machines for lime spreading MA 3,5 and MA 4,5 type; Equipments for fertilizer spreading MIC 500; reversible ploughs with 3 or 4 mould-boards and heavy disc harrows GDG 2,7 for destruction the old grass sward; rotary cultivator FPP 1,3 and FU 2,5 type for destruction of the old sward and seedbed preparing; disc harrows GDU 4,2 and/or combined cultivators CPGC 3,9 or CPGC 4,2 type for seedbed preparing; Ring roller TI 5,5 type for rolling before/after sowing; universal seeders SUP 29 for sowing fodder grass plants etc. Operation of such

equipment and machinery is done with tractors appropriated to requirements of power and slopes.

Table 1

New technological variants for mechanization of grassland improvement by reseeding method

Operation	Recommended aggregate(*		
	Code	Draft presentation	Aggregate component
0	1	2	3
a. Degraded grasslands with deep layer of fertile topsoil and thin grass sward			
a.1. Variant 1			
Destruction of the old sward and liming	**U1**		Wheel tractor of 74-88 kW (100-120 HP) + Heavy disc harrow GDG 2,7 + Equipment for chemical fertilization EF 2,5
Seedbed preparation and fertilization with chemical fertilizers	**U2**		Wheel tractor of 74-88 kW (100-120 HP) + Rotary harrow2,5 m width + Equipment for chemical fertilization EF 2,5
Rolling before/after sowing, sowing of fodder grass plants	**U3**		Wheel tractor of de 59-74 kW (80-100 HP) + Special machine for sowing fodder grass plants MSPFP 2,5
a.2. Variant 2			
Destruction of the old grass sward, seedbed preparing, sowing of fodder grass plants, rolling after sowing and fertilization with chemical fertilizers	**U4**		Wheel tractor of 74-88 kW (100-120 HP) + Rotary tiller-drill machine improved MCT 2,5M + Equipment for chemical fertilization EF 2,5
b. Degraded grasslands with deep layer of fertile topsoil and deep grass sward			
b.1. Variant 1			
Clearing of non value vegetation, of mole-hills and fertilization with chemical fertilizers	**U5**		Wheel tractor of 60 -74 kW (80-100 HP) + Machine for clearing grasslands MCP 2,5 + Equipment for chemical fertilization EF 2,5
Destruction of the old sward and liming	**U1**		Wheel tractor of 74-88 kW (100-120 HP) + Heavy disc harrow GDG 2,7 + Equipment for chemical fertilization EF 2,5
Seedbed preparation and fertilization with chemical fertilizers	**U2**		Wheel tractor of 74-88 kW (100-120 HP) + Rotary harrow2,5 m width + Equipment for chemical fertilization EF 2,5
Rolling before/after sowing, sowing of fodder grass plants	**U3**		Wheel tractor of de 59-74 kW (80-100 HP) + Special machine for sowing fodder grass plants MSPFP 2,5
b.2. Variant 2			
Clearing of non value vegetation, of mole-hills and lime spreading	**U6**		Wheel tractor of 60 -74 kW (80-100 HP) + Machine for clearing grasslands MCP 2,5 Equipment for chemical fertilization EF 2,5
Destruction of the old grass sward, seedbed preparing, sowing of fodder grass plants, rolling after sowing and fertilization with chemical fertilizers	**U4**		Wheel tractor of 74-88 kW (100-120 HP) + Rotary tiller-drill machine improved MCT 2,5M + Equipment for chemical fertilization EF 2,5

0	1	2	3
c. Degraded grasslands with thin layer of fertile topsoil and deep grass sward			
Clearing of non value vegetation, of mole-hills and lime spreading	**U6**		Wheel tractor of 60 -74 kW (80-100 HP) + Machine for clearing grasslands MCP 2,5 + Equipment for chemical fertilization EF 2,5
0	1	2	3
Destruction of the old grass sward, seedbed preparing, sowing of fodder grass plants, rolling after sowing and fertilization with chemical fertilizers	**U4**		Wheel tractor of 74-88 kW (100-120 HP) + Rotary tiller-drill machine improved MCT 2,5M + Equipment for chemical fertilization EF 2,5
d. Degraded grasslands with thin layer of fertile topsoil and thin grass sward			
Destruction of the old grass sward, seedbed preparing, sowing of fodder grass plants, rolling after sowing and fertilization with chemical fertilizers	**U4**		Wheel tractor of 74-88 kW (100-120 HP) + Rotary tiller-drill machine improved MCT 2,5M + Equipment for chemical fertilization EF 2,5
e. Grasslands affected by erosion			
Destruction of the old grass sward and seedbed preparing	**U7**		Wheel tractor of 74-88 kW (100-120 HP) + Heavy disc harrow GDG 2,7
Fertilization with chemical fertilizers, rolling before/after sowing, sowing of fodder grass plants	**U8**		Wheel tractor of de 59-74 kW (80-100 HP) + Special machine for sowing fodder grass plants MSPFP 2,5 + Equipment for chemical fertilization EF 2,5

(* When the operations on the grasslands affected by erosion and also located on slope conditions are required following measures:

- On slope greater than 7^0 (12 %) required works are operated on the level curves according to strictly following technology: on long versants, where soil erosion is favoured, the works required to grass establishment must be operate in parallel bands with level curves. Uncultivated bands are to be worked into next year when the first set of bands is already established. Bands vary in width depending on the slope size as follows: on slopes of $7\text{-}9^0$ (12-16%) between 30 and 40 m; on slopes of $9\text{-}14^0$ (16-25 %) between 20 and 30 m; on slopes of $14\text{-}18^0$ (25-32 %) between 12 and 20 m, respectively on slopes of $18\text{-}22^0$ (32-40%) between 7 and 12 m. Operation of machinery and equipments is done by special tractor for slopes conditions (tractor with double traction, equipped with double wheels or caterpillar tracks) (MOCANU V., HERMENEAN I., 2008).

RESULTS AND DISCUSSIONS

Situation on working capacity, specific fuel consumption needs and necessary work force for each aggregate, recommended within new technological solutions of mechanization for improvement of degraded grasslands by reseeding is presented in Table 2.

In Table 3 are presented the total fuel consumption, necessary work force and the number of machine passes, both for usual variants and new technological solutions.

The data are given for each situation in which the degraded grasslands is located (a, b, c, d and e).

From the data presented in Table 3 and Figure 1, depending on working conditions and degradation stage of grassland, finds the following:

- Total fuel consumption for usual alternatives varies between 30.1 and 86.75 l / ha;
- Total fuel consumption for new mechanization solutions varies between 20.4 and 65.4 l / ha;

Table 2

Specific fuel consumption and necessary work force for recommended aggregates

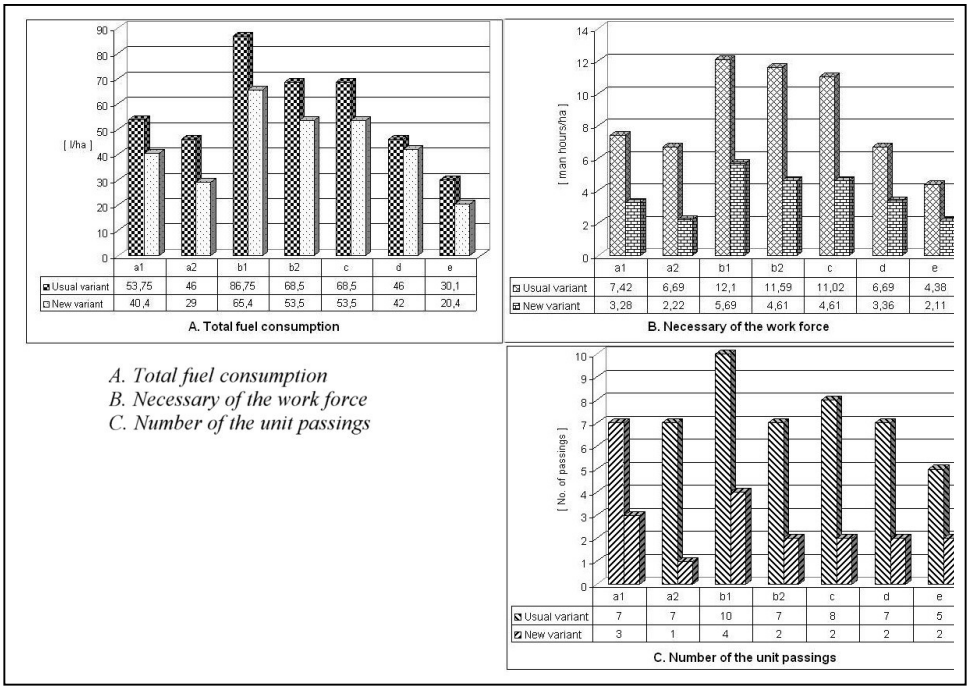
Code of aggregate	Capacity of working [ha/daily work time]	Specific fuel consumption [l/ha]	Necessary work force [man hours/ha]
0	1	2	3
U1	7	13	1,14
U2	7	21	1,14
0	1	2	3
U3	8	6,4	1,00
U4	3,6	29	2,2
U5	4,5	15	1,78
U6	3,5	19,5	2,11
U7	8	13	1,00
U8	7,2	7,4	1,11

Table 3

Comparative situation of usual and new technological solutions for mechanization of works to improve the grasslands

Specification	Technology		Fuel consumption [l/ha]	Consumption of labour [man hour/ha]	Number of aggregate passage pieces
a. Degraded grasslands with deep layer of fertile topsoil and thin grass sward	Usual variant	Var.1	53,75	7,42	7
		Var.2	46,0	6,69	7
	New variant	Var.1	40,4	3,28	3
		Var.2	29,0	2,22	1
b Degraded grasslands with deep layer of fertile topsoil and deep grass sward	Usual variant	Var.1	86,75	12,1	10
		Var.2	68,5	11,59	7
	New variant	Var.1	65,4	5,69	4
		Var.2	53,5	4,61	2
c. Degraded grasslands with thin layer of fertile topsoil and deep grass sward	Usual variant		68,5	11,02	8
	New variant		53,5	4,61	2
d. Degraded grasslands with thin layer of fertile topsoil and thin grass sward	Usual variant		46,0	6,69	7
	New variant		42	3,36	2
e. Grasslands affected by erosion	Usual variant		30,1	4,38	5
	New variant		20,4	2,11	2

- Consumption of labour for usual variants of mechanization varies between 4.38 and 12.1 man hours/ha;
- Consumption of labour for new mechanization technologies varies between 2.11 and 5.69 man hours/ha;
- The number of aggregate passes for usual solutions varies between 5 and 10;
- The number of aggregate passes for new mechanization solutions varies between 1 and 4.



A. Total fuel consumption
B. Necessary of the work force
C. Number of the unit passings

CONCLUSIONS

Compared with usual variants new mechanization technologies for improving degraded grasslands by reseeding method require a reduced consumption of fuel and labour, with a smaller number of aggregate passes.

Thus, depending on working conditions and solution of mechanization appointed, the fuel consumption is reduced with 4.0-21.35l/ha.

Utilization of new technologies for mechanization of works to improve the degraded grassland by reseeding provides the decreasing of work force consumption with 2.27-6.98 man hours/ha. Also, the number of aggregate passes by using the new technological solutions decreases from maximum 10 passages to minimum one pass.

By lowering fuel consumption, the consumption of work force and the number of machine passes, new technological solutions of mechanization of work for improving degraded grasslands by reseeding method have o reduced environmental impact, environment pollution (air, water, soil) is less, inputs are lower and costs decrease proportionately**.**

BIBLIOGRAFY

1. MOCANU V., HERMENEAN I., and MARUSCA T., 2008 - Ecological and economical technology for mechanization of grassland improvement works; Proceeding of the 22nd General Meeting of the European Grassland Federation, Uppsala, Sweden, 144 -146.
2. MOCANU V., HERMENEAN I., 2008 - Technologii pentru mecanizarea cu inputuri minime a lucrărilor de întreţinere şi îmbunătăţire a pajiştilor. Editura Universităţii Transilvania din Braşov.