NEW MECHANIZATION ALTERNATIVES WITH LOW INPUTS FOR OVER SOWING DEGRADED GRASSLANDS

NOI VARIANTE DE MECANIZARE CU INPUTURI REDUSE A LUCRĂRILOR DE ÎMBUNĂTĂȚIRE PRIN SUPRAÎNSĂMÂNȚARE A PAJIȘTILOR DEGRADATE

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Abstract: *The paper is well suited for current tendency for promoting new technological solutions for mechanization of grassland farming with low input systems. New technological alternatives, full presented in the paper, are focused on mechanization of over sowing operations for improvement of degraded grasslands invaded by mole-hills of different sizes and density level or invaded both of non value vegetations and mole-hills. The over sowing consists in realizing the optimum conditions of plant growing, diminishing the competition of the old sward and over sowing operation. New technological alternatives for mechanization of over sowing operation are based on composing of complex aggregates using the current research results from agricultural mechanization field. The utilization of the complex farming aggregates provide the realization of 2, 3 or 4 operations by one pass machine, in comparison with usual variants within are used simple aggregates, achieving one or two operations by one passing. Therefore the new technological solutions of mechanization involve less fuel consumptions, lower necessary labour, reduced passes number, depending on stationary area conditions and mechanization alternative. Because of these advantages, new mechanization solutions for improvement of degraded grasslands by over sowing method have a low ecological impact, less environment pollution, lower inputs in according with low production costs.*

Rezumat: *Lucrarea este de actualitate deoarece promovează noi verigi tehnologice de mecanizare cu inputuri reduse a unor lucrări de pe pajişti. Noile variante tehnologice, prezentate detaliat în lucrare, se referă la mecanizarea lucrărilor de îmbunătăţire prin supraînsămânţare a pajiştilor degradate invadate de muşuroaie de diferite dimensiuni şi grade de acoperire sau invadate atât de vegetaţie nevaloroasă cât şi de muşuroaie. Supraînsămânţarea constă în crearea de condiţii optime pentru dezvoltarea plantelor, de diminuare a competiţiei vegetaţiei existente şi de supraînsămânţare propriu-zisă. Noile verigi tehnologice de mecanizare a lucrărilor de supraînsămânţare se bazează pe formarea de agregate complexe folosind realizări recente ale cercetării din domeniul mecanizării lucrărilor pe pajişti. Folosirea agregatelor complexe permite realizare la o singură trecere a 2 sau chiar 3 operaţii, în timp ce variantele clasice utilizează agregate simple, care 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 de muncă mai mic, un număr diminuat de treceri ale agreagatelor. Datorită acestor avantaje noile verigi tehnologice de mecanizare a lucrărilor de supraînsămânţare a pajiştilor degradate 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 for mechanization, over sowing, degraded grasslands*
Cuvinte cheie: *verigi de mecanizare, supraînsămânţare, pajişti degradate*

INTRODUCTION

The over sowing technology for improvement of degraded grasslands consists in introduction of improved herbage species into the old sward by partial tilling.

The over sowing of degraded grasslands is a rapid, economic and certain method for improvement of damaged areas being successfully suitable on surfaces marked by: less density of grass sward; undesirable species (weeded area), peaty of heavy soils where ploughing isn't possibly, having as results the decreasing of soil portability and animal stocking rate; eroded and sliding grounds; nude terrains after the control of non value wood vegetations and mole-hills levelling operation; padlocking surfaces; for environment protection, where the total tillage (ploughing, rotary cultivating etc.) isn't possible.

This paper presents new technological solutions with low inputs for mechanization the over sowing of degraded pastures.

New technological solutions of mechanization of over sowing workings are based on complex farming aggregates composed of current research results from farming mechanization field as fertilizer equipments, EF 2.5 and EF 3.75 type, equipment for herbicide on bands, EEB 2.5 type, respectively sowing equipment, ESR 3.75 type, and specific farming machinery and equipments.

MATERIALS AND METHODS

The technology of over sowing degraded pastures consists in following working groups: operations for realising the optimum conditions of plant growing; operations for diminishing competition of the existing vegetation; over sowing operation and operations for grassland utilization after over sowing (HERMENEAN I., MOCANU V., 2002).

The operations for realizing the optimum conditions of plant growing are composed from liming, phosphorus and potassium fertilizing and non value vegetation, mole-hills and stones clearing.

The control of the competition from the existing vegetation must be done both before and after over sowing operation about 10 days.

The proper over sowing must be made in optimal sowing time in according with agricultural and quality requirements utilizing suitable seed mixtures.

In comparison with usual technology, new technological solutions use complex aggregates providing the realization of 2 or more operations by one pass machine and less passing number.

Thereby, depending on working conditions and grassland degradation level can be used aggregates which can perform: clearing the mole-hills and old vegetation simultaneously with fertilising; clearing simultaneously with over sowing operation; control of competition from the old grass sward before over seeding simultaneously with fertilization; proper over sowing simultaneously with control of competition from the old grass sward (MOCANU V., HERMENEAN I., 2008).

Depending on working conditions and degradation level of grasslands, can be met next situations:

a. Degraded grassland overgrown with mole-hills;

b. Degraded grassland overgrown with large mole-hills and high density level;

c. Degraded grassland overgrown with non value vegetation and mole hills.

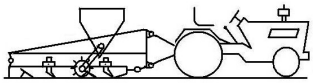
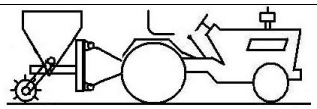
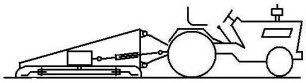
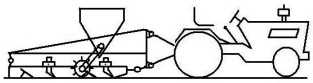
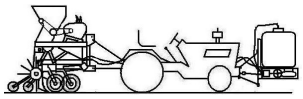
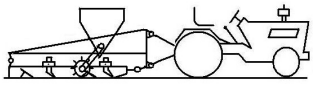
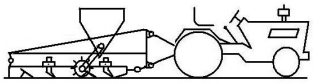
New technological solutions for mechanization of grassland over seeding operations are presented schematically in table 1, being conditioned by working conditions and degradation level of pasture (a, b and c situation presented above) (MOCANU V., HERMENEAN I., 2008).

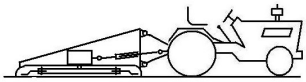
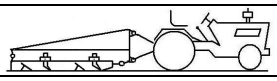
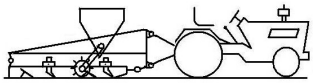
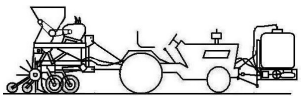
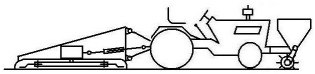
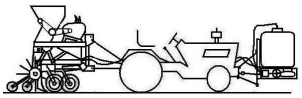
Usual alternatives of mechanization of works to improve the degraded grasslands through over seeding method use farming aggregates that operate one simple work by one pass. Depending on the operation are used equipment and specific machinery or suitable for other crops such as: for clearing the mole-hills, uneven grounds and animal excrement spreading,

equipments for grassland levelling; for clearing the mole-hills and non value vegetation, machines MCP 2,0 type; for spreading the chemical fertilizer machines MIC 500 type; for proper over sowing, direct drilling machines for over sowing the degraded pastures MSPD 2.5 type; for controlling the old grass sward competition by cutting and chopping, machines for grassland clearing MCP 2.0 type. Operation of such equipment and machinery is done with tractors suitable for working in slope conditions (HERMENEAN I., MOCANU V., 2002 , HERMENEAN I., MOCANU V., 2008).

Table 1

New mechanization solutions for improving grassland by over seeding method

Operation	**Recommended aggregate(***		
	Code	**Draft presentation**	**Aggregate component part**
0	1	2	3
a. Degraded grassland overgrown with mole-hills			
a.1. Variant 1			
- Clearing of mole-hills and micro uneven grounds and animal excrement spreading; - Grass sward aeration; - Over seeding	U1		Wheel tractor of 48-60 kW (65-80 HP) + Equipment for grassland levelling + Equipment for grassland seeding ESR 3.75 type
- Chemical fertilization (phosphorous and potassium)	U2		Wheel tractor of 33-40 kW (45-55 HP) + Equipment for fertilizing EF 3.75 type
- Controlling the old grass sward competition after over sowing by cutting and chopping	U3		Wheel tractor of 60 -74 kW (80-100 HP) + Machine for grassland clearing MCP 2.5 type
a.2. Variant 2			
- Clearing of mole-hills and micro uneven grounds and animal excrement spreading; - Grass sward aeration; - Chemical fertilization (phosphorous and potassium)	U4		Wheel tractor of 48-60 kW (65-80 HP) + Equipment for grassland levelling + Equipment for fertilising EF 3.75 type
- Proper over sowing; - Controlling the old grass sward competition	U5		Wheel tractor of 60 -74 kW (80-100 HP) + Machine of over seeding of degraded grassland MSPD 2.5 type+ Equipment for herbicide in bands EEB 2.5 type
b. Degraded grassland overgrown with large mole-hills and high density level			
b.1. Variant 1			
- Clearing of mole-hills and micro uneven grounds and animal excrement spreading; - Grass sward aeration; - Chemical fertilization (phosphorous and potassium)	U4		Wheel tractor of 48-60 kW (65-80 HP) + Equipment for grassland levelling + Equipment for fertilising EF 3.75 type
A second perpendicular crossing consists in - Clearing of mole-hills and micro uneven grounds and animal excrement spreading; - Grass sward aeration; - Over seeding	U1		Wheel tractor of 48-60 kW (65-80 HP) + Equipment for grassland levelling + Equipment for grassland seeding ESR 3.75 type

0	1	2	3
- Controlling the old grass sward competition after over sowing by cutting and chopping	U3		Wheel tractor of 60 -74 kW (80-100 HP) + Machine for grassland clearing MCP 2.5 type
b.2. Variant 2			
- Clearing of mole-hills and micro uneven grounds and animal excrement spreading	U6		Wheel tractor of 48-60 kW (65-80 HP) + Equipment for grassland levelling
A second perpendicular crossing consists in: - Clearing of mole-hills and micro uneven grounds and animal excrement spreading; - Grass sward aeration; - Chemical fertilization (phosphorous and potassium)	U4		Wheel tractor of 48-60 kW (65-80 HP) + Equipment for grassland levelling + Equipment for fertilising EF 3.75 type
- Proper over sowing; - Controlling the old grass sward competition	U5		Wheel tractor of 60 -74 kW (80-100 HP) + Machine of over seeding of degraded grassland MSPD 2.5 type+ Equipment for herbicide in bands EEB 2.5 type
c. Degraded grassland overgrown with non value vegetation and mole hills			
- Controlling of the old grass sward competition by clearing the non value vegetation, mole-hills, micro uneven ground and animal excrement spreading; - Chemical fertilization (phosphorous and potassium)	U7		Wheel tractor of 60 -74 kW (80-100 HP) + Machine for grassland clearing MCP 2.5 type + Equipment for fertilizing EF 2.5 type
- Proper over sowing; - Controlling the old grass sward competition	U5		Wheel tractor of 60 -74 kW (80-100 HP) + Machine of over seeding of degraded grassland MSPD 2.5 type+ Equipment for herbicide in bands EEB 2.5 type

(* During working on grasslands affected by erosion phenomena and those located on the land slope are required following measures:

- on slope greater than 7^0 (12 %) required works are operated on the curves level according to strictly following technology: the long versants, where soil erosion is favoured, over sowing operations are made in alternative strips, parallel to the curves level. Uncultivated strips are to be work into next year when the first set of grass bands is already established. Bands vary in width depending on the slope sizes 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 and labour needs for each aggregate, recommended in the new technological solutions is presented in table 2.

In Table 3 are presented the total fuel consumption, necessary labour and the number of aggregate passes, both for usual variants and new solutions of mechanization of work to improve degraded grassland through over sowing method. Data are given for each work condition and situation in which the degraded grassland there is (a, b and c).

Table 2

Specific fuel consumption and necessary labour force for recommended aggregates

Code of aggregate	Working capacity [ha/daily operating time]	Fuel consumption [l/ha]	Necessary labour force [man hour/ha]
0	1	2	3
U1	8	4,6	1,00
U2	12	3,0	0,67
U3	10	6,5	0,80
U4	8	4,8	1,00
U5	8	7,5	1,00
U6	10	4,2	0,80
U7	4,5	15,0	1,78

Table 3

Comparative situation of usual variants and new technology of mechanization with reduced inputs to improve degraded grassland by over sowing method

Specification	Technological solutions of mechanization		Consumption of fuel [l/ha]	Consumption of labour force [man hours/ha]	Number of aggregate passes
a. Degraded grassland overgrown with mole-hills	Usual variant		22,4	3,61	4
	New variant	Variant 1	14,1	2,47	3
		Variant 2	12,3	2,00	2
b. Degraded grassland overgrown with large mole-hills and high density level	Usual variant		26,2	4,41	5
	New variant	Variant 1	15,9	2,8	3
		Variant 2	16,3	2,8	3
c. Degraded grassland overgrown with non value vegetation and mole-hills	Usual variant		33,2	5,1	4
	New variant		22,5	2,78	2

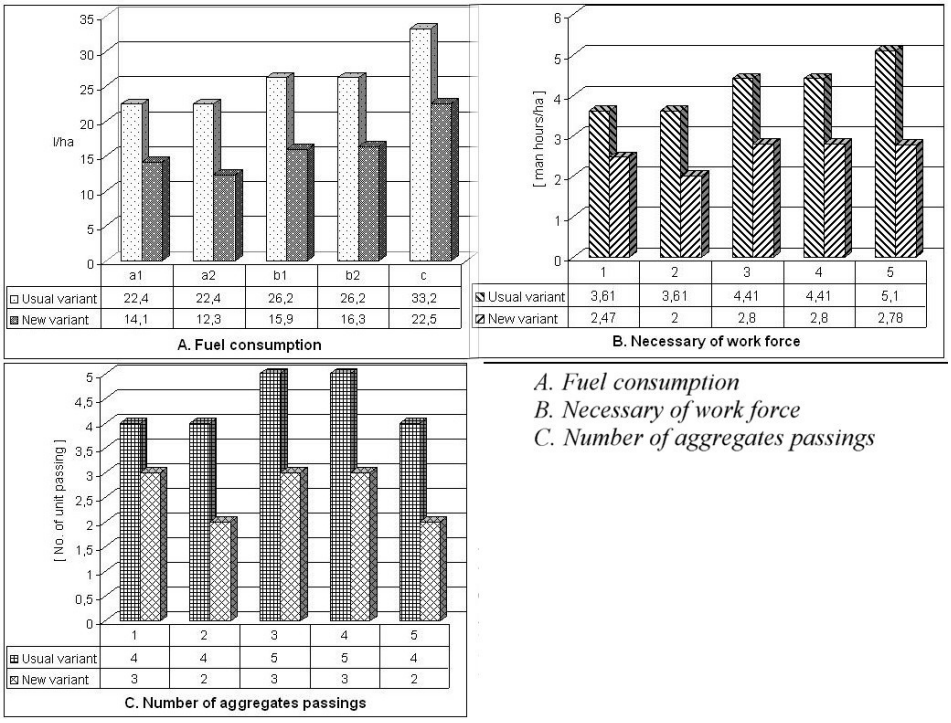
From the data presented in table 3, depending on working conditions and degradation stage of grassland (a, b, c) finds the followings:

- total consumption in usual variants ranges of 22.4 and 33.2 l/ha, figure 1;
- total fuel consumption in new mechanization variants varies between 12.3 and 22.5 l/ha, figure 1;
- consumption of labour for usual variants of mechanization varies between 3.61 and 5.61 man hours /ha , figure 1;
- consumption of labour for new variants of mechanization varies between 2 and 2.8 man hours/ha, figure 1;
- number of aggregate passes for usual variants of mechanization varies between 4 and 5, figure 1;
- number of aggregate passes for new variants of mechanization varies between 2 and 3, figure 1.

CONCLUSIONS

Compared with usual variants of mechanization, new technological solutions of mechanization of works to improve the degraded grasslands through over sowing method require a reduced consumption of fuel and labour with a smaller number of passes of aggregates.

Thus, depending on working conditions and variants of mechanization appointed the fuel consumption is reduced by 8.3 -10.7 l/ha.



A. Fuel consumption
B. Necessary of work force
C. Number of aggregates passings

Using new mechanization solutions leads to reduction of work force with 1.14 – 2.32 man hours/ha.

Also, the number of aggregates passes by using the new technology of mechanization is diminishing from a maximum of 5 passes at least 2 passes, depending on working conditions and variants of mechanization chosen.

By lowering the fuel consumption and number of passes, new technology of mechanization of workings to improve the degraded grasslands by over seeding method have a reduced ecological impact, environmental pollution (air, water, soil) is lower, inputs are minimal and cost shall be reduced proportionately.

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