NEW TECHNOLOGICAL SOLUTIONS FOR GRASSLAND IMPROVEMENT BY OVER SOWING METHOD

Tudor Adrian ENE[1], Vasile MOCANU[2]

Abstract. *In this paper new technological solutions for mechanization of grassland farming are presented. Technological alternatives are focused on mechanization of over sowing operations for improvement of degraded grasslands invaded by hummocks of different sizes and density rates or invaded both of non-value vegetation and hummocks.New technological alternatives for mechanization of the over sowing operations are based on complex aggregates, using the current research results from agricultural engineering. The utilization of the complex farming aggregates provide realization of 2 or 3 operations by one passing machine, while within usual variants are used simple aggregates, achieving one operation by one pass. In comparison with usual variants, the new technological solutions of mechanization require less fuel consumptions, lower necessary labour force and reduced passing number.*

Keywords: technological variants, over sowing, improvement, equipment, machines.

1. Introduction

The operation of grassland over sowing (direct drilling) consist of introducing the grass and legume seeds into the soil, where competition from the existing sward can be diminished.

The over sowing of degraded grasslands is a rapid, economic and certain method for improvement of degraded grasslands, being succesfully suitable on surfaces, such as: less density of grass sward; the soils where the total tillage (ploughing, rotary cultivating etc.) isn't possible and there is risk of decreasing the soil portability and animal stocking rate; eroded and sliding grounds; nude terrains after the control of non-value wood vegetation and hummocks leveling operation; paddocking surfaces [2].

New technological solutions of mechanization of over sowing workings are based on complex farming aggregates, using current research results from agricultural engineering as fertilizer equipments, EF 2,5 and EF 3,75 type,

[1]PhD, Eng., Junior Researcher, Research-Development Institute for Grassland Braşov, Romania, (e-mail: tudorene@yahoo.com).
[2]PhD, Eng., Senior Researcher, Research-Development Institute for Grassland Braşov, Romania, (e-mail: vasmocanu@yahoo.com).

equipment for herbicide on bands, EEB 2,5 type, respectively sowing equipment, ESR 3,75 type and specific machinery and equipments for grassland farming.

2. Materials and methods

The over sowing technology of the degraded grasslands is intended to: realising the optimum conditions for plant growing; diminishing the competition of the old vegetation; over sowing and grassland utilization after over sowing operation.

For realizing the optimum conditions for plant growing, operation involves: liming, phosphorus and potassium fertilizing and non value vegetation, hummocks and stones clearing.

The control of the competition from the old grass sward must be done both before and after over sowing operation.

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

Thereby, depending on work conditions and grassland degradation level, can be used aggregates as: clearing the hummocks and old vegetation simultaneously with fertilising; clearing simultaneously with over sowing; diminishing the old grass sward competition before over sowing simultaneously with fertilization; over sowing simultaneously with diminishing the old grass sward competition [1].

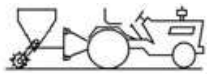
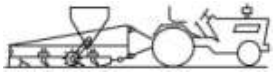
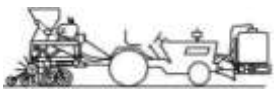
Depending on stationary area conditions, can be met next situations:
a-degraded grassland with hummocks: **see Figure 1**;
b-degraded grassland with large hummocks and high density level: **see Figure 2**;
c-degraded grassland because both non value vegetation and hummocks: **see Figure 3**.

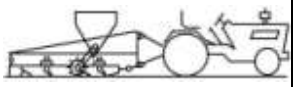
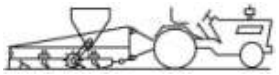
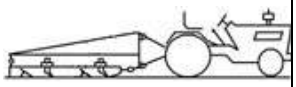
In table 1, new tehnological solutions for mechanization of grassland over sowing in according with working conditions and degradation stage of grassland (a, b or c), are schematically presented [1].

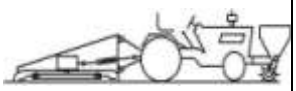
Usual technology for over sowing the degraded grasslands uses aggregates providing the realization of one operation by one pass machine. Depending on the stationary area conditions and operation, are used specific equipment and machinery or suitable for other crops such us: for clearing the hummocks, micro uneven grounds and animal excrement spreading, equipment for grassland levelling; for diminishing the old grass sward competition by clearing the hummocks, micro uneven grounds and animal excrement spreading, machine for grassland clearing MCP 2,5 type; for clearing the hummocks and non value vegetation, machine for grassland clearing MCP 2,5 type; for spreading the chemical fertilizer, machine MIC 500 type; for over sowing, direct drilling

machine for over sowing the degraded grassland MSPD 2,5 type; for diminishing the old grass sward competition by cutting and chopping, machine for grassland clearing MCP 2,5 type. Operation of such equipment and machinery is done with tractors suitable for working in slope conditions [1, 2, 3].

Table 1. New technological variants for mechanization of grassland improvement by over sowing method [1]

Operation	**The recommended aggregate(***		
	Code	**Draft presentation**	**Aggregate component**
0	1	2	3
a. Degraded grassland with hummocks			
a.1. Variant 1			
- clearing of hummocks and micro uneven grounds und animal excrement spreading; - grass sward aeration; - over sowing.	**U1**		Wheel tractor of 78-60 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
- diminishing the old grass sward competition 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 hummocks, 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
- over sowing; - diminishing the old grass sward competition.	**U5**		Wheel tractor of 60-74 kW (80-100 HP) + Machine of over sowing of degraded grassland MSPD 2,5 type + Equipment for herbicide in bands EEB 2,5 type

b. Degraded grassland with large hummocks and high density level			
b.1. Variant 1			
- clearing of hummocks, 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 passing consist in: - clearing of hummocks and micro uneven grounds and animal excrement spreading; - grass sward aeration; - over sowing.	**U1**		Wheel tractor of 78-60 kW (65-80 HP) + Equipment for grassland levelling + Equipment for grassland seeding ESR 3,75 type
- diminishing the old grass sward competition 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			
- cleaning of hummocks and micro uneven grounds and animal excrement spreading	**U6**		Wheel tractor of 60 -74 kW (80-100 HP) + Equipment for grassland levelling
A second perpendicular passing consist in: - clearing of hummocks, 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
0	1	2	3
- over sowing; - diminishing the old grass sward competition.	**U5**		Wheel tractor of 60-74 kW (80-100 HP) + Machine of over sowing of degraded grassland MSPD 2,5 type + Equipment for herbicide in bands EEB 2,5 type

c. Degraded grassland with non-value vegetation and hummocks			
- diminishing the old grass sward competition by clearing the non-value vegetation, hummocks, micro uneven ground and animal excrement spreading; - chemical fertilization (phosphorous and potassium).	**U7**		Wheel tractor of 60 -74 kW (80-100 HP) + Machine for clearing grasslands MCP 2,5 + Equipment for chemical fertilizing EF 2,5 type
- over sowing; - diminishing the old grass sward competition.	**U5**		Wheel tractor of 60-74 kW (80-100 HP) + Machine of over sowing of degraded grassland MSPD 2,5 type + Equipment for herbicide in bands EEB 2,5 type

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

-on slope greater than 7^o (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 strips with level curves;

-uncultivated strips are to be worked into next year when the first set of bands is already established;

-strips vary in width depending on the slope size as follows: on slope of $7\text{-}9^o$ (12-16%) between 30 and 40 m; on slope of $9\text{-}14^o$ (16-25%) between 20 and 30 m; on slope of $14\text{-}18^o$ (25-32%) between 12 and 20 m, respectively on slope of $18\text{-}22^o$ (32-40%) between 7 and 12 m;

-operation of machinery and equipment is done by special tractor for slopes conditions (tractor with double traction, equipped with double wheels or caterpillar).

3. Results and discussion

In table 2 are presented the total fuel consumption, necessary labour force and the number of machine passes, both for usual and new technological solutions.

Table 2. New technology for improving the degraded grasslands by over sowing method [1, 3].

Specification	Technology		Fuel consumption, l ha^{-1}	Necessary labour force, man hour ha^{-1}	Number of passes
a.Degraded grasslands with hummocks	Usual		22,4	3,61	4
	New	Var 1	14,1	2,47	3
		Var 2	12,3	2,00	2
b.Degraded grasslands with large hummocks and high density level	Usual		26,2	4,41	5
	New	Var 1	15,9	2,80	3
		Var 2	16,3	2,80	3
c.Degraded grassland with non-value vegetation and hummocks	Usual		33,2	5,10	4
	New		22,5	2,78	2

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

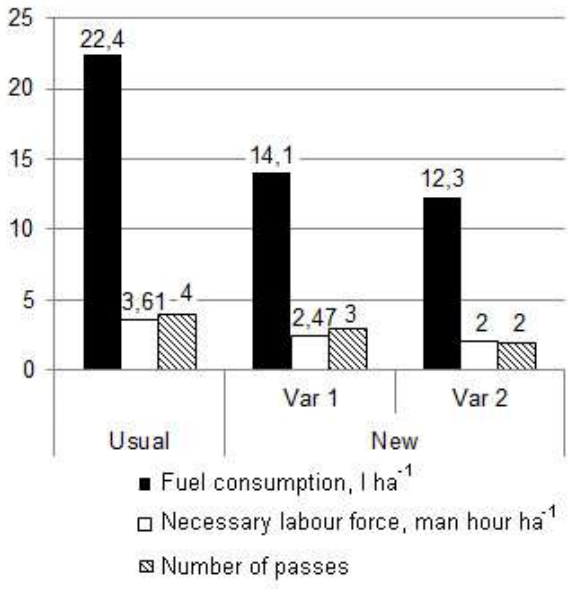

Fig.1. Comparative of fuel consumption, necessary labour force and number of passes between new and usual technology, for degraded grassland with hummocks.

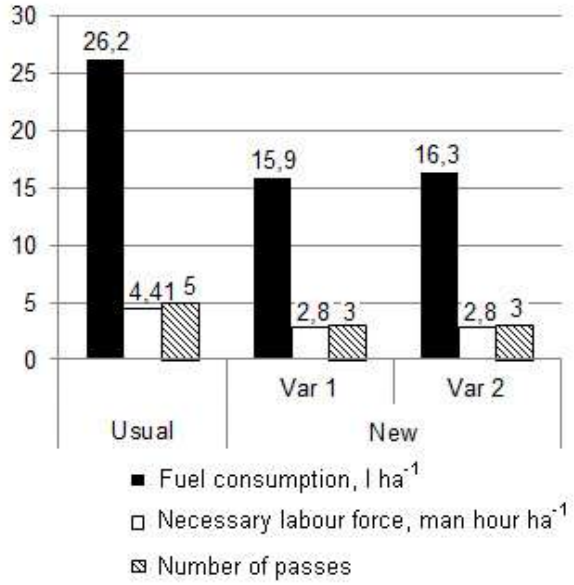

Fig.2. Comparative of fuel consumption, necessary labour force and number of passes between new and usual technology, for degraded grassland with large hummocks and high density level.

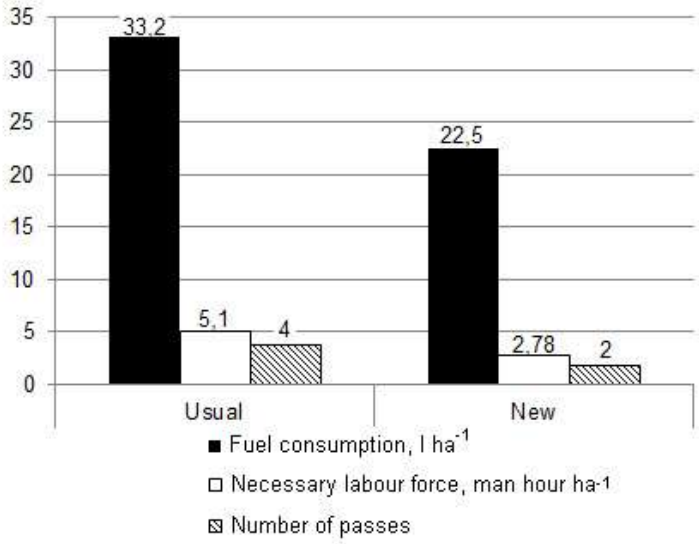

Fig.3. Comparative of fuel consumption, necessary labour force and number of passes between new and usual technology, for degraded grassland because both non value vegetation and hummocks.

The data presented in Table 2 and Figures 1, 2 and 3, in according with working conditions and degradation stage of grassland, demonstrates the following:

- total fuel consumption for usual alternatives varies between 22,4 and 33,2, l ha^{-1};
- total fuel consumption for new mechanization solutions ranges between 12,3 and 22,5, l ha^{-1};
- consumption of labour force for usual variants of mechanization varies between 3,61 and 5,1, man hour ha^{-1};
- consumption of labour force for new mechanization technologies ranges between 2,0 and 2,8, man hour ha^{-1};
- the number of aggregate passes for usual solutions varies between 4 and 5;
- the number of aggregate passes for new mechanization solutions range between 2 and 3.

4. Conclusions

The new mechanization technologies for improving the degraded grasslands by over sowing method, compared with usual variants for different stationary area conditions, require a reduced comsumption of fuel (33...45 %) and labour forces (37...45 %) with a smaller number of aggregate passes (1...2).

By lowering fuel consumption, necessary labour force and the number of machine passes, new technological solutions of mechanization of works for improving degraded grasslands, by over sowing method, have a reduced environmental impact, environment pollution (air, water, soil) is less, inputs are lower and costs decrease proportionally.

References

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