COMBINED MACHINES FOR SEEDBED PREPARATION AND SOWING A NECESSITY FOR APLYING ADVANCED TECHNOLOGIES IN CROP PRODUCTION

V. Crăciun[1], E. Nitescu[2] , O. Balan[3] , M. Magureanu[4]

Abstract: *In the paper the authors present some theoretic considerations and experimental researches concerning the use of the combined machines for seedbed preparation and sowing, using two passes or a single pass of the machine across the land. This modern technology, whose performances in practice are demonstrated by many agricultural machinery manufacturers and by farmers is the one which could conduct romanian farmers to make more rapidly the pass from the Conventional Agriculture to Sustainable Agriculture. The qualitative indices of the working process, the reduced fuel consumption, the conservation of soil properties avoiding soil compaction and conserving soil biotope, the reduced costs of the labor due to high productivity are the main advantages these new technologies brings along.*

Keywords: tillage, seedbed, sowing machines, soil properties, sustainable agriculture

INTRODUCTION

Usually, in Romania, the seedbed preparation are made by different implements as subsoilers, ploughs, disk harrows, combined tillage machines, packers, all these machines making several passes across the land. These techniques are ruinous for the soil structure due to the compaction and pulverization and loss of the soil moisture. On the other hand, these techniques brings loss of time and increased costs of crop establishment, by big fuel consumption, salaries and by using a lot of unperforming machines and finally, determine a small income for farmer.

It is very well known that in agriculture is very important the season of sowing. Using conventional technologies, with successive tillage implements across the land, it takes a lot of time, the loss of the soil moisture and sometime in the fall, because of heavy rains, snow and bad whether, could impede sowing and so crop establishment.

For the above given reasons, the researchers from all over the world [Alcok et all.1989; Buzatu, I.,Sandu, F.,1987; Bittenbrinder, 1996; Dutzi, 1996; Sarbu, et al.1996, Silsoe Research Insitute, UK-1995] and many reputed companies which are manufacturing agricultural maschines (KUHN, RAU, Maschio, Lemken, Amazone, John Deere etc) have developed new machines and technologies for seedbed preparation and sowing, using two passes or a single pass of the machine across the land. Table 1 summarize the main technical features of such combined machines wich entered Romanian agriculture. Fig.1 show a proposed technological scheme of a combined machine [7-Silsoe Research Institute Report, 1994-1995]. All these machines combines active and passive elements for tillage and seedbed preparation and a sowing machine. The passive elements are conventional chisel tines, subsoilers, sweeps, disks, leveling bars, rollers etc. The active elements consists of rotary tillers with vertical or horizontal axis or by oscilating teeth harrows. Sowing machines are of the usual tipes ; in Romania are in use those manufactured by "Mecanica Ceahlau" S.A. Piatra Neamt and MAT S.A. Craiova.

Table 1.

Main technical features of the combined machines for seedbed preparation and drilling wich entered Romanian agriculture

Nb.	Machine manufacturer	Configu-ration	Working depth (cm)	Working width (cm)	Theoretical power requirement (kW/hp)	Specific Power required (kW/m)
1	DUTZI 2400	D, RT,	18	240	75/102	31-37

		R				
2	DUTZI KR-3600	D, RT, S , T	18-30	360	120/163	33÷36
3	Landsberg	CT, R	28	400	118/160	20÷33
4	KUHN HRB-402	CT, R, S, H	20- 25	400	103/140	25,75
5	KUHN HA 3000	CT, R, S, H	max 28	300	37/50	12,33
6	KUHN FASTLINER 3000	O, S, R, H	Direct drilling	300	150/200	50
7	LEMKEN	CT, S, R	18	300-450	83/120	29÷33
8	EMONDS	CT, R	18	200-400	132/180	33
9	POLYMAT	CT, S, R	18	250-400	132/180	33
10	APS- 2,5 Mecanica- Ceahlau-RO	RT, S, O	20	250	88/120	35,2
11	ROTOMAT 3000- MAT SA Craiova, Ro	D, CT, R	10-25	300	132/180	43
12	Polymat	RT, S, R	18	250-400	132/180	34
13	RAU- rototiller	D, RT, S, R	22	220-400	103/140	25-26
14	AMAZONE	RT,S, R,H	18	250-400	90/135	36

- Legend: D-deep chiseling ; C-chisel; CT- cyclotiller; RT-rototiller; S-sowing machine; R – packer roller; H-harrow ; O-others (leveling bars, disks, chains etc

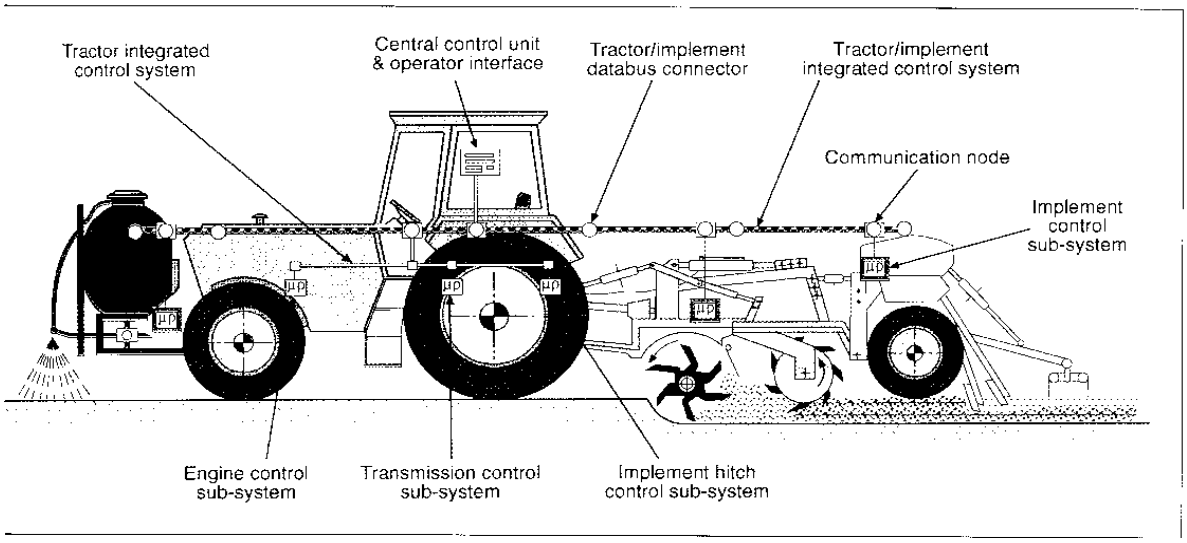

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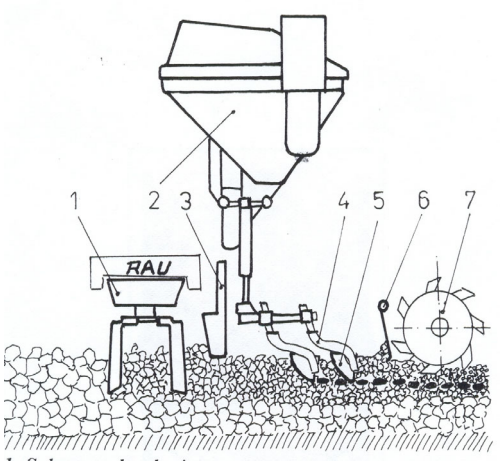
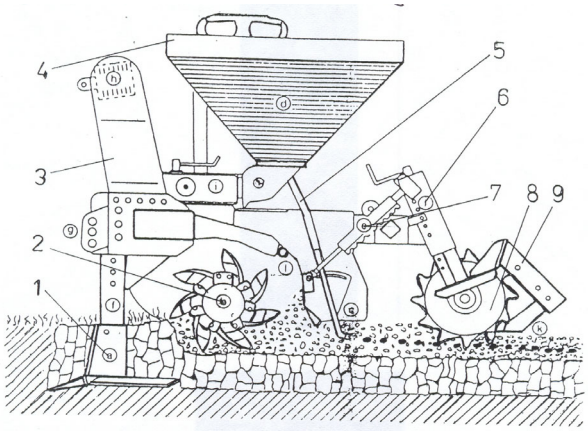
Fig.1. A proposed structure of integrated tractor and implement control system [annual report 1994- 1995, Silsoe Research Institute, UK]

MATERIALS AND METHODS

To demonstrate the advantages of the conservating technologies and machines for the seedbed preparation and sowing in comparision with conventional technologies, in the table 2 are shown the fuel consumption for three different mechanized technologies for crops establishment: **a)** conventional, **b**) two passes of the aggregate across the land, **c)** a single pass of the aggregate across the land. The consumption are given as they results form the recommendations of the Romanian Ministry of Agriculture [9], from commercial advertising of different enterprises [9] and from the romanian agriculture companies which are using such machines [Bittenbrinder,1996; Buzatu,I., Sandu,A.. 1987; Dutzi, F.; 1996; Gus, P.; 1998; Sarbu et al.; 1986].



1.cyclotiller,2.hopper,3.levelling blade, 4.drill seed tubes, 5.shoe opener, 6.leveling blade, 7.packer roller



1. Deep chisel, 2. rototiller, 3.Frame,4.hopper,5.seed tubes, 6,7.adjusting screws, 8.toothed packer, 9.beam of scrapers

Fig. 2. Technological schemes for the combined machines for tillage and sowing [RAU- Germany, DUTZI- Germany]

The fuel consumed in performing these operations is one of the principal indicators of the efficiency with which this useful work can be accomplished with these machines. From the table 2 results that we can obtain very important fuel consumption economy using the tecnhologies **b** and **c**; if we consider fuel consumption for **a** technology being 100%, **b**, is 88% and **c** range from 40% up to 60%. Considering that Romania has about 10.000.000 arable land which is tilled mechanicaly could result a huge economy of fuel if the method **b** and **c** will be used oll over the country (if we will consider an economy of 20 l/ha, will result an economy up to 200000 t /year).

Table 2.

The average fuel consumption for three different mechanized technologies for crops establishment in the romaninan agriculture [9]

The crop	Wheat (in stubble)		Hoeing plants (in stubble)		Tractors
	Slope 0^0	Slope 9^0	Slope 0^0	Slope 9^0	
a.Conventional technologies					
plowing + harrowing (PP 4-30+ GCR-1,2)	27	29	27	30	U-650 U-800
disking I (GD-3,4)	9	10	9	9,5	U-1010
disking II (GD-3,4)	8	8,5	8	9	DT
sowing (SUP-29)	4	5,5	5,4	5,5	U-650
packing (TEM-4,5; TIT-5,5)	3	3,2	3	3,2	U-650
Total fuel consumption for *a*	**51**	**56,2**	**52,4**	**57,2**	

(l/ha)					
b. New technology (two passes of the aggregate on land)					
Plowing PP-3-30 (25 cm) + harrowing Rotary tilling+leveling+sowing+packing	27 20	29 20	29,5 18	27 19	U-650,U-800 U-650,U-800
Total fuel consumption for b scheme (l/ha)	**47**	**49**	**47,5**	**46**	
c. New technology (a single pass of the aggregate on land)					
Deep Chiseling+ Rotary tilling+ leveling+ sowing + packing (DUTZI, RAU, KUHN, MASCHIO, in unplowed land)	**29 -33**	**29 -33**	**29 -33**	**29 -33**	T-195, FORD 8770, STEYR, New Holland etc.

In fig.3 are presented the comparative results obtained in an experience in field, reported by Bittenbrinder Alfred , 1996, using the romanian tractor T-195, in the aggregate with the combined machine Dutzi KR-3600 (structure presented in fig.2), for a surface of 1600 ha, in Banat region, Romania.

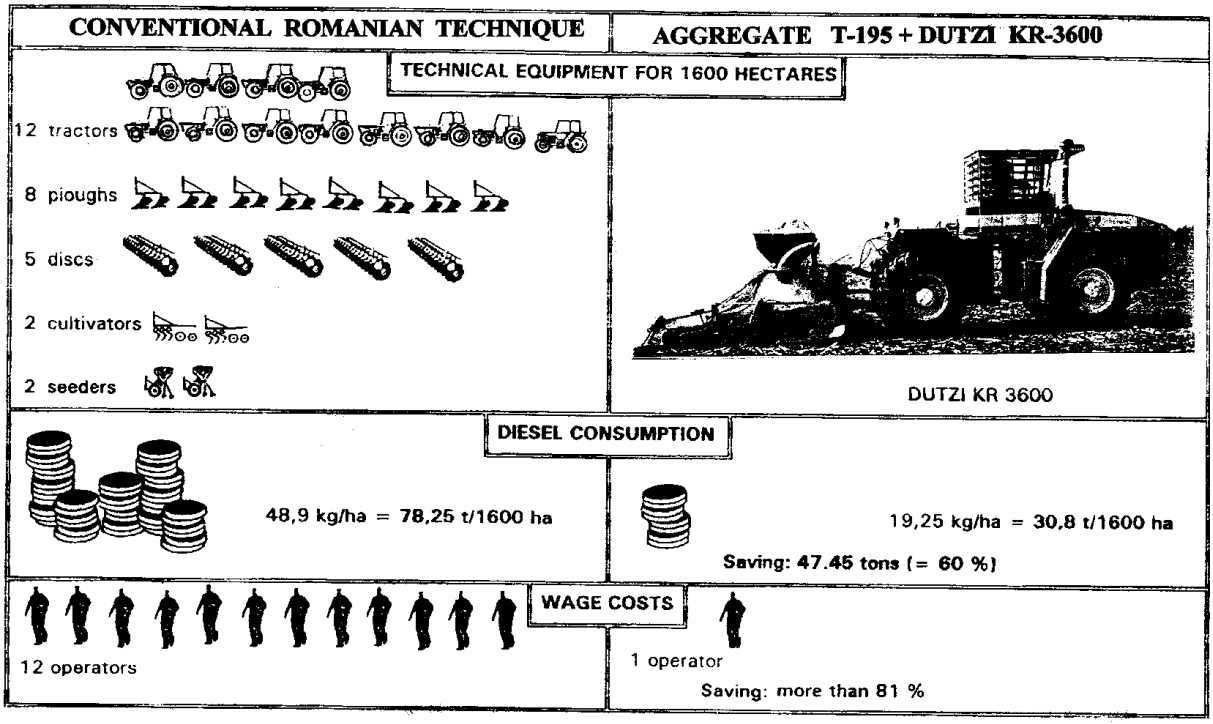


Fig.3. Comparison between conventional romanian technique for crop establishment and a sustainable system ; romanian tractor T-195 and german combined machine Dutzi KR- 3600 [2].

A comparison between the results obtained using conventional system of machines and combined machine shown in fig.3, demonstrate that the fuel consumption is reduced up to 60% (in comparation with the technology with two passes on land), the wage costs have been reduced up to 80 % ; if it is used a single pass across the land the average yield was 29% higher than the average control

yield. This difference might be explained by a higher rate of the moisture evaporation when we use two passes of the machines across the land. We didn't made evaluations concerning the comparative conditions of the fisical properties of soils on two parcels of the land.

CONCLUSIONS

1.Combined machines for seedbed preparation and sowing could be manufactured on the base of the existing series machines;
2.Cobined machines offer the possibility to setting up crops in the proper season time, at low costs and with best results: small specific fuel consumption, high rate of emergence for plants; high labor productivity, high income;
3.Aggregates with combined machines needs big power tractors; the specific power needed vary from 25 up to 36 kW/m, for the majority of the combined machines;
4.The use of the combined machines for seedbed preparation and sowing is benefic to the soil and environment; these machines avoid soil pulverization, soil compaction and conserve the soil moisture and the soil biotope.

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ABOUT THE AUTORS

1. Ph.D. Professor, Deptartment of Agricultural Machinery, Faculty of Mechanics, The „Gh.Asachi" Technical University IASI, ROMANIA; e-mail : vcraciun@ma.tuiasi.ro;
2. Ph.D., Professor, Deptartment of Land Reclamation and Environment Protection, Hydrotechnic Faculty, The „Gh.Asachi" Technical University IASI, ROMĂNIA;
3. Ph. D., Associate professor, Department of Agricultural Machinery, Faculty of Mechanics, The „Gh.Asachi" Technical University IASI, ROMANIA; 232 172286;
4. M.Sc. Eng. Manager, SC NOVUS SRL Constanta;Romania; e-mail: NovusCo@yahoo.co.uk