MECHANISATION TECHNOLOGY IN SOWING WHEAT IN CHIȘINEU CRIȘ, ARAD COUNTY, ROMANIA

C.CREȚ[1], P.ȘERAN[1], Anișoara DUMA COPCEA[1], Casiana MIHUȚ[1], Nicoleta ȚIGRIȘ [2], R. ILEA[1]

University of Agricultural Sciences Banat Veterninară „King Michael I of Romania" Timisoara, Arad Way, no. 119, Romania, Phone: +4025627475, Fax: +40256200296,
[2]Şcoala Gimnazială Racoviţa, Timiş

Emails:, duma_anisoara@yahoo.com ,
Corresponding author: duma_anisoara@yahoo.com,

Abstract. *Research was carried out in the conditions specific to Chișineu Criș, Arad County, Romania. The oils in the Crişului Alb Plain are chernozems, solonchaks, vertisols, and gleysols. The study is about wheat culture, the crop most extended in the area. Besides wheat, in the area they also cultivate on large areas grain maize and, on smaller areas, fodder crops. In the fall of 2016, they sowed 100 ha with wheat. Harvesting was done in June 2017. Seed and sowing. To be used for sowing, seed must be adapted to an area, come from acknowledged crops with high biological value, with minimum 98% physical purity, with minimum 90% germination, and with the highest weight of 1,000 grains. Plants from large seeds form the jointing node deeper, are better rooted, and resist better to low temperatures. The sowing period has great influence on the future crop, since it allows good jointing in the fall and storage of nutrients for the cold season and good resistance to wintering. Experimental data point out that the best results are when, during the 40-50 days from sprouting to winter (when temperature goes below +5°C), there is accumulation of 450-550°C. This corresponds to beginning of sowing, when air temperatures decreases to 13-15°C, and ending of sowing, when it reaches 8-9°C. For plain areas in southern and western Romania and for the Transylvanian Plain, this corresponds to September 25 – October 15, and. For the hill areas, to September 15 -20 – October 1. In the areas around the mountain area, sowing must be finished by September 25. Plant density. There are normal yields when there are 500-700 ears/m^2. This can be ensured by sowing 400-600 germinable grains/m^2, depending on the cultivar jointing ability. Seed amount varies, depending on its biological value, purity, and weight of 1,000 grains, between 200-280 kg/ha. Row distance is 10-15 cm. sowing in rows 6 cm close should be done only on lands with no plant debris and with a high chopping degree. In the last years, increasingly more countries have adopted the uncultivated path cultivation method allowing equipment for fertilisation and pest treatment. They, thus, avoid benchmarking, overlapping of soil works or soils not worked at all, and no crop damage. Sowing depth is established depending on the soil type and texture, on water supply and on germinating energy, and it ranges within 4-7 cm. under good moisture conditions, wheat should be sowed at 4-5 cm and, on dry soils, at 6-7 cm, in cultivars with long coleoptile. Fertilisation. Basic fertilisation was done before sowing with complex fertilisers 20.20.0 at rates of 250 kg/ha. During vegetation, they spread 220 kg/ha ammonia nitrate and 10 kg/ha urea.*

Keywords*: mechanisation technology, wheat culture, fertilisation*

INTRODUCTION

The farm where we carried out this study on wheat has two tractors (Fendt 615 LS and U 650M), a reversible plough with 4 Lemken Opal 140 bodies, a Maschio SC 300 agricultural mill, a maize sowing machine, a SUP 29M cereal sowing machine, a fertiliser for solid chemical fertilisers, a herbicide spraying machine, two trailers, a bailer and a John Deere 1450 CWS cereal harvesting combine. The mechanisation technology for wheat sowing is:-seed rate: N = 300 kg/ha;-row distance: d = 12.5 cm;-sowing area: 100 ha (1000 m × 1000 m);-sowing aggregate: U650M tractor + SUP 29M sowing machine.

MATERIAL AND METHOD

This was done with a U-650M tractor in aggregate with a Gaspardo Vulcano Maxi fertiliser. *Ploughing* was done in August 2016 at a depth of 20 cm. The ploughing aggregate consisted in a Fendt Favorit 615LS tractor + Lemken Opal 140 reversible plough. *Soil preparation.* Preparation of the germination bed was done with a Fendt Favorit 615LS tractor in aggregate with a Maschio SC 300 agricultural mill. *Sowing was done between September 15 and 20, 2016. Seed rate was 280 kg. The sowing aggregate consisted in a U-650M tractor + SUP 29M sowing machine Protection treatments* aimed at weed, disease, and pest control using a U-650M tractor in aggregate with an EEP-600 carried sprayer.Sowing was d0oen with an aggregate made up of a U-650 tractor and a universal SUP-29 M carried sowing machine. *The universal SUP-29M carried sowing machine* has been designed for sowing on rows cereals, trefoil, alfalfa, peas, parsley, carrots, onion, radish, etc. It works in aggregate with U-650M tractors and it sows on 29 rows at 12.5 cm distance. While advancing, sowing aggregates open ditches in the soil at specific depth. The right wheel of the sowing machine operates, through the Northon box, the seed distributors of the spur cylinder type. After attaching the sowing machine to the tractor and after feeding the box with seeds, they regulate machine horizontality, owing depth, row distance, trace marker length, seed flow, and sowing testing. Preparing the sowing machine is done following the sequence: preparation of the SUP-29M sowing machine to sow wheat at a rate of 300 kg/ha, with a tractor span of 150 cm. Here I an excerpt of the technical book of the machine: - damper position – intermediary;- small clap position – 2 grooves; - Northon speed box position – D2. The sowing machine is tested as follows:- the collecting spout is set horizontally;- the operating wheel is turned 15 times, which corresponds to the flow of proper seed amount for an area of 100 m^2; theoretical flow q_t is one hundredth of the rate, i.e. q_t = 3 kg; - the seeds collected in the spout are weighed thus producing the real flow – qr. If the real flow does not equal theoretical flow, then the handle of the Northon box is changed and the process goes on until the two flows are equal, i.e. 3 kg. After obtaining the amount needed, the spout is set vertically.Working depth is set as follows: pieces of wood 2-3 cm less thick than the sowing depth (for oil setting) are introduced beneath the tractor wheels to allow all coulters to reach the platform. If they do not, they need to be turned with a wrench until all touch the platform. Markers' length is fixed taking into account that the trace of a marker needs to be followed by the front wheel of the tractor facing the sowed land:-we calculate the length of the two markers with the relation: $L_{ms} = L_{md} = \frac{B-E}{2} + d$ [mm] = 112.5 cm; where: B – distance between extreme coulters (B = 28 · 12.5 = 350 cm); E – tractor span (E = 150 cm); d – row distance (d = 12.5 cm); - we measure from the outer coulter 112.5 cm and mark it on the platform, we loosen the screws on the support pipe pf the marker moving the telescope rod with the marking disc until the lower margin of the disc periphery touches the mark on the platform and then we tighten the screws. We fix the poker position so that they aerate the soil along the traces left by the tractor at a depth equal to the sowing depth. To work the land cultivated with wheat we used two type pf tractor: -the Favorit 615 LS tractor; - the U-650 M tractor. Operation parameters for the Fendt Favorit 615 LS tractor are: - nominal power P_m = 150 CP = 112 kW; - nominal engine moment M_e = 70 daNm; -hourly fuel consumption G_h = 28 l/h;- fuel intake = 220 l; - weight G = 5800 daN. The Fendt Favorit 615 LS tractor has 16 speeds ranging between 3.4-40 km/h.

RESULTS AND DISCUSSION

Resistance force to traction in the sowing machine: $R_M = K \cdot n = 50 \cdot 29 = 1450\ daN$ where: K – specific resistance per coulter in daN/m; N – number of disc coulters. *Working speed:* Comparing traction resistance of the sowing machine R_m with the traction force F_t of the U-650M tractor, we chose the 2nd speed to do the sowing. The working speed is: $v_l = v_t(1-\delta) = 2,7 \cdot (1-0,15) = 2,3\ m/s = 8,3\ km/h$ *Sowing aggregate working capacity:* Real hourly working capacity is calculated with the relation: $W_h^r = 0,1 \cdot B_l \cdot v_l \cdot K_s = 0,1 \cdot 4 \cdot 8,3 \cdot 0,7 = 2,3\ ha/h$ .Real hourly working capacity per shift is calculated with the relation: $W_{sch}^r = W_h^r \cdot T_s = 2,3 \cdot 8 = 18\ ha/sch$. The duration of a working cycle is: $T_c = \frac{L_l \cdot n_l}{v_l} + \frac{L_g \cdot n_g}{v_g} = \frac{(930+42)\cdot 2}{2,3} = 845\ sec.$ Theoretical area worked after a cycle is calculated with the relation: $W_c = \frac{L_l \cdot n_l \cdot B_l}{10^4} = \frac{930 \cdot 2 \cdot 6}{10000} = 1,1\ ha/ciclu$. Hourly theoretical working capacity is: $W_h = 3600 \cdot \frac{W_c}{T_c} = 3600 \cdot \frac{1,1}{845} = 4,7\ ha/h$ .Fuel consumption per ha is: $C_{ha} = \frac{C_h}{W_h} = \frac{27\ l/h}{4,7\ ha/h} = 6\ litri/ha$.

Calculus of economic indices

Number of hours/aggregate: $C_a = \frac{T_s}{W_{sch}^r} = \frac{8}{28} = 0,29$ aggregate-hours/ha.

Coefficient C_m for aggregate functioning: $C_m = C_a \cdot m = 0,29$ man-hour/ha. Payment costs per ha: $C_S = C_m \cdot S = 0,29 \cdot 15 = 4$ RON/ha. Fuel costs: $C_c = G_{ha} \cdot p_i = 6 \cdot 5 = 30$ RON/ha. Aggregate amortization rate for C_A $C_{Atractor} = \frac{V_i - V_r}{W_{sch}^r \cdot n_s \cdot n_z \cdot D} = \frac{300000}{28 \cdot 250 \cdot 10} = 4,3$ RON/ha;

$C_{Asem.} = \frac{V_i - V_r}{W_{sch}^r \cdot n_s \cdot n_z \cdot D} = \frac{150000}{28 \cdot 250 \cdot 8} = 2,7$ RON/ha; $C_A = 4,3 + 2,7 = 7$ RON/ha.

Aggregate technical service costs for C_{dt} : $C_{dttractor} = \frac{V_i \cdot G_{ha}}{C_n} = \frac{300000 \cdot 6}{450000} = 4$ RON/ha; $C_{dtsem.} = \frac{V_i}{W_n} = \frac{150000}{55000} = 3$ RON/ha. Aggregate technical service costs: $C_{dt} = 4 + 3 = 7$ RON/ha. Direct costs per sowed ha: $C_d = C_S + C_c + C_A + C_{dt} = 4 + 30 + 7 + 7 = 48$ RON/ha. *Auxiliary costs*

for $C_{ac}: C_{ac} = 0{,}2 \cdot 48 = 10$ RON/ha. *Total cost* of one ha prepared with the combinator: $C_T = C_d + C_{ac} = 48 + 10 = 58$ RON/ha.

CONCLUSIONS

Based on our results, we can draw the following conclusions and make the following recommendations. In sowing aggregates, time use coefficient per shift has low values (0.55 ... 0.65) due mainly to frequent stops to feed the seed to machines. To increase aggregate working capacity, we recommend a good scheduling of the works: choosing movement direction along the long side of the plot, benchmarking the first itinerary and markers to indicate further itineraries, ensuring the feeding of seed boxes at one of the ends of the plot, supervising seed distribution during work. Sowing aggregates work properly if their construction and fixing ensure stability of seeding rate and distribution of evenness over the width of the plot. Checking is done stationarily on seed distributors and seed collectors. Quality of ploughing is checked permanently to be able to take measures in case of deficiencies. All checking regarding work quality must be done per aggregate taking proper remediation measures, if necessary, for the work to meet quality standards:-Sowing fuel consumption per ha is 6 l.;Total costs of sowing was 58% RON/ha; -Main factors influencing wheat yield in 2017: crop rotation, quality of mechanised works, climate conditions, sowing time, supply of nutrients.; -Doing mechanised works at optimal time and at normal soil moisture have a considerable impact on yield because well-aerated soil with no clogs allows plant sprouting and development;-Proper amount of nutrients as chemical fertilisers is a must to ensure normal development in wheat: high supply of nitrogen results in vigorous plant growth, but the lack of other macro- and micro-elements causes unbalance in plants, which affects plant growth and development causing low yields; -High yields per ha with low costs involve strictly observing cultivation technologies by using complex agricultural aggregates with high profitability;-Under the conditions of 2017, wheat cannot ensure good yield or notable profit; -Productivity of agricultural equipment and of fuel consumption are impacted negatively by the high rate of soil breaking-up.

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