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*Dragoljub MITROVIĆ, Radisav DUBLJEVIĆ¹***ANALYSIS OF THE PERFORMANCE OF THE ROTOPRESS COMBI AGRONIC R-500 IN THE PREPARATION OF LUCERNE****SUMMARY**

Lucerne can be used to produce hay, silage, haylage and flour. During production, losses can occur due to mechanical damage of the leaves by the activity of the machines used in the production and the harvesting of the crop.

Silage problems may also occur, and a larger quantity of preservatives may be needed. In addition, special conditions may have to be adhered to, and larger harvesters may be necessary.

This work presents the results of lucerne green grass mass preparation using a rotobaler, which represents a significant technological solution to the formation of cylindrical-shaped packages weighing between 60 and 70 kg and wrapped with plastic folio. The performance of the rotobaler Agronic R-500 was assessed at a site in Niksic (Montenegro) in 2008. The results point to the sustainable application of this rotobaler in the preparation of lucerne green grass mass.

Keywords: rotobaler, lucerne, haylage, productivity

INTRODUCTION

In the preparation of silage and alfalfa haylage performed during physiological maturity, silage appears to create favourable conditions for the development of lactic acid fermentation. If we take into account the fact that alfalfa is difficult to ensile at the silo facilities (bunker silo, silo pits) with the use of preservatives, as well as requiring a line of machines ready to transport it, storing silage is a better conceptual solution.

Silage and haylage using rotary presses, bale wrapping with polyethylene film has many advantages, for mowing and wilting humidity of 30-50% lasting several hours (High, 1998). Preservation of grass silage in Western Europe is preparing about 56% in the form of bales, wrapping with polyethylene film (Charney and Cherney, 1998). Silage and haylage is performed in physiological provenutosti, and creating conditions for the development of fermentation, which is implemented in the dry matter content of 35-40% (Jones, 1995). As an important factor in saving the alfalfa silage are anaerobic conditions, to prevent the work of fungi that cause decay.

To obtain high quality silage and haylage, alfalfa should be cut in stages or before flowering (Ćupina, Dubljević, 2005). Timely mowing, crushing and

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drying of grass mass greatly affects the quality of silage and haylage. The success of baled silage depends on the quality, thickness and colour of film. According to Lingwall (1995), the film is white and better (better) than a black foil because white reflects the sun's light and transfers less heat to the bale ensiled mass.

Roto balers and presses for forming cylindrical bales of fresh grass or provenute mass than the formation of certain bundle size, different density in its process of bale wrap formed from polyethylene foil. This way of storing masses of fresh grass, silage and haylage represents a technological solution that solves the problem of storing alfalfa and clover-grass mixtures, as well as the problem of storage.

Silage can be stored for 3 to 4 months (Mo and Sue, 1988) and according to Forristal (1995), baled silage can be stored without significant loss for 6 to 18 months. Storing silage depends on the thickness of the film, according to (Savoie, P, 1988); up to 3 months of film thickness is 100 μm (micrometers), up to 7 months is 150 microns, and up to 12 months is 200 μm .

MATERIAL AND METHODS

The performance of the rotopress in relation to the production of cylindrical-shaped bales was evaluated in 2008 at the lucerne production lot in the Niksic area. Analyses of the rotopress model R 500 combi Agronic R-500 with an aggregate operational power of 30 kW in the preparation of lucerne in the fourth (IV) swath were performed. A production parcel $p = 10,740 \text{ m}^2$ (length 358 m and width 30 m) was assigned for the analysis. The lucerne was mowed with a rotary lawn mower Sip-165, with a working width of 1.65 and a universal pull-power unit of 35 kW.

The program for analysing the aggregate used in the preparation and the baling of the mowed lucerne included determining the following parameters:

- Walkthrough length in meters (m);
- Walkthrough time in minutes (min);
- Turnaround time in minutes (min);
- Length of the distance travelled when making a bale in meters (m);
- Time for forming a bale in minutes (min);
- Working speed of the aggregate (km/h);
- Dimensions of the formed bale (axb);
- Weight of the formed bale in kilograms (kg);
- Volume of the formed bale (kg/m^3);
- Polyethylene foil consumption (m^2);
- Number of bales formed at the distance examined;
- Productivity of the aggregate (ha/h, ha/day, bale/h, bale/ha and bale/day).

RESULTS AND DISCUSSION

1. Technical characteristics of rotopress model R 500, combi Agronic R-500

Length.....	3,500 mm
Width.....	1,850 mm
Height.....	1,520 mm
Weight.....	790 kg
Number of revolutions of the power take-off/shaft....	540 min ⁻¹
Working width pick up.....	830 mm
Pneumatics	(26 x12 x 12)
Power required for the power unit.....	30 kW

2. Technological characteristics of the rotopress or rotobaler

The rotopress or rotobaler examined is a machine used to form cylindrical bales. The drive power for the device and the movable parts are provided by a tractor attached shaft, through power take-off and a hydro-engine. The formation and wrapping of the formed bale are automatic, and the work process is observed via a monitor. In the work process, the gathering or pick-up device of the rotopress lifts up the mowed grass mass from the swath using elastic teeth and delivers it to the pressing chamber. The grass mass is then pressed in the chamber, increasing the size of the bale to the projected size.

The tension belt rises and automatically tightens the received grass mass, forming a bale of a certain compression and solidness. When the bale forms the projected size and weight, it is fastened, wrapped with polyethylene foil and then transported using a special device to the lot area. The bales are loaded with a tractor loader equipped with specially designed clamps. The work process involved in the production of the rotobales largely depends on the grass mass yield, power unit adjustments and skills of the person handling the power unit.



Figure 1. Rotobaler combi Agronic R-500

3. Operational indicators of the aggregate work are

The average working speed of the aggregate was 3.4 km/h. The formation of bales with an average mass of 67.5 kg was completed on average at a walkthrough length of 135.5 m. Thus, the average time for bale formation was

2.4 min. The average volume of the formed bale was to 0.56 m^3 . The amount of polyethylene foil used in forming a bale was $51 \text{ m} \times 0.25$, equating to an area of $12.75 \text{ m}^2/\text{bale}$.

Table 1. Operational indicators of the aggregate

Walkthroughs	Walkthrough length (m)	Walkthrough time (min)	Turnaround time (min)	Length for forming a bale (m)	Time for forming a bale (min)	Size of the formed bale (axb)	Weight of the bale (kg)	Volume of the bale (kg/m^3)	Foil consumption. (m^2)	No of bales (pcs)
1	358	7,0	0,25	120	2,35	0,16	65	406	12,75	3,00
2	358	6,5	0,33	160	2,90	0,16	70	437	12,75	2,25
3	358	7,0	0,25	110	2,15	0,16	68	425	12,75	3,25
4	358	6,0	0,37	128	2,14	0,16	71	444	12,75	2,80
5	358	6,0	0,37	165	2,76	0,16	66	412	12,75	2,20
6	358	6,0	0,36	130	2,18	0,16	65	406	12,75	2,75
X average	358	6.42	0.32	135,5	2.40	57x63	67.5	0.56	12.75	2.7

Table 2. Aggregate productivity

Walkthroughs	Working speed km/h	ha/h	ha/day	kg/day	bale/h	bale/ha	bale/day
1	3,1	0,37	2,96	11205	26	56	166
2	3,3	0,40	3,20	9072	21	42	134
3	3,1	0,37	2,96	12096	28	60	179
4	3,6	0,43	3,44	12096	28	52	179
5	3,6	0,43	3,44	9504	22	41	141
6	3,6	0,43	3,44	11664	27	51	173
X average	3,4	0,40	3,24	10935	25	50	162

The productivity of the examined aggregate was on average 0.40 ha/h or 3.24 ha/day. The average yield of lucerne was 3,333 kg/ha. The productivity of the formed bales varied from 21–27 bale/h to 41 to 60 bale/ha, which represents a daily productivity rate of 162 bale/day.

CONCLUSION

On the basis of the presented parameters for the analysis of the aggregate rotopress, model „Combi, Agronic R-500“ in the preparation of lucerne haylage, the following conclusions can be derived:

1. The rotopress model „Combi, Agronic R-500“ represents a technical-technological solution to the preparation of green grass lucerne mass.
2. There are numerous advantages to preparing fresh lucerne with a rotobaler and wrapping the formed bales with polyethylene foil compared with the preparation of haylage and silage. These include:
 - higher retention of fresh green mass;
 - losses of green grass mass are reduced to a minimum;
 - better meal balance;
 - certain machines are excluded from the preparation process, such as the hay turner and hay rake, silo combine for silage, silo and tower silo;
 - transport and storage are simplified;
 - preparation process is economical;
3. The aggregate analysed represents a conceptual solution to the preparation of fresh green mass, haylage and silage of clover-grass mixtures and lucerne.
4. The rotopress combi AGRONIK-R 500 is suitable for use on uneven ground, with side elevations and small production areas.

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**EKSPLOATACIONA ISPITIVANJA ROTO PRESE COMBI
AGRONIC R-500 KOD SPREMANJA SILAŽE LUCERKE**

SAŽETAK

Spremanje lucerke se može obaviti u vidu: sijena, silaže i sjenaže. Kod spremanja sijena lucerke, javljaju se mehanički gubici koje izazivaju elementi priključnih mašina za tretman pokošene mase. Gubici mogu biti i do 40 % ukupne lisne mase u zavisnosti od vlažnosti u trenutku tretmana.

U radu su prikazani rezultati spremanja silaže od travne mase lucerke, pomoću roto prese, koja predstavlja značajno tehnološko rešenje u formiranju bala cilindričnog oblika, mase od 60 do 70 kg i omotavanjem sa polietilenskom folijom. Ispitivanja roto prese AGRONIC model R-500 combi, obavljena su na lokalitetu Nikšića u 2008 godini. Rezultati ispitivanja ukazuju na opravdanost primjene roto prese u spremanju silaže lucerke.

Ključne riječi: roto baler, lucerka, silaža, sjenaža, proizvodnost, agregat.