

## Comparison of rollers after sowing of buckwheat

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### Analysis and modelling

#### ABSTRACT

**Purpose:** This paper compares the effect of three types of rollers (rubber, edged and smooth) upon sprouting of three sorts of buckwheat seed ('Darja', 'Bamby' and 'Gorenjka'). Rolling is a very important soil cultivation measure after sowing of small seed such as the buckwheat seed, particularly, during the time of drought when the test was performed.

**Design/methodology/approach:** A field test was carried out on divided lots of land in a random block. Sowing and rolling were performed on 6 June 2003. During that period there was an extreme drought causing lack of humidity in the ground. The plants were counted on the 10 and 12 July, i.e., on the fourth and sixth day after sowing. There were most sprouting plants in case of rubber rollers, followed by smooth and edged rollers.

**Findings:** The least plants sprouted on the non-rolled lots of land. The sort had a statistically characteristic effect on the share of plants sprouting during the fourth and sixth day after sowing.

**Research limitations/implications:** The research was carried out only with three types of rollers and three sorts of buckwheat seed.

**Practical implications:** The sort 'Gorenjka' had most sprouting plants, followed by the sort 'Bamby' and the sort 'Darja' with least sprouting plants.

**Originality/value:** In our researches it was proved that the most favourable combination is the rubber roller and the sort 'Gorenjka'.

**Keywords:** Statistic methods; Rollers; Cultivation of soil; Field test

### 1. Introduction

Rolling is a secondary soil cultivation process. It removes the deficiencies committed during ploughing. After ploughing the rollers stamp and press the soil so that it subsides and closes faster, i.e., so that the loosened ploughed soil is pressed against the non-ploughed soil ensuring the water to pass from lower to upper soil layers. Rolling also straightens the wavy surface area and crushes the clods and lumps. The clods the roller cannot crush are pressed into the soil. Thus, the effect of soil herbicides is improved. Rolling is carried out after sowing if the soil is dried excessively in case of spring or summer cultivation of the stubble field. Such rolling is aimed at faster sprouting of the seed and is

almost always necessary for small seeds. This assures the capillary rise of water and the even sprouting because the soil surface is straightened. Gentle rolling of soil before sowing ensures better contact of the seed with earth and a more even sprouting of the seed. The fields are rolled also after ploughing-in the farmyard manure, the plants to be underfurrowed (the plants for green manuring) or the stubbles with much organic mass, if the soil is too loose. Rolling presser the soil, it crushes the clods, it reduces the volume of non-capillaries and thus increases the capillary rise of water.

Rolling is required particularly after sowing small seeds during the summer months to attract moisture to the seed and to assure good conditions for faster and more even sprouting [1].

## 2. Description of rollers

Rollers are the tools able to bring benefits or damage when preparing the soil for sowing. They may be harmful if the soil rolled is too wet. The rollers crush and compact the soil, they crumble the clods, they press the soil and the seed so that the latter sprouts faster. They also topple the green plants which will be ploughed in. The rollers crumble by their weight, shape and speed [2, 3, 4]. Rubber, smooth, edged (disc and toothed rollers), underground rollers etc. are distinguished. For the test the rubber, smooth and edged rollers were used.

Rubber rollers consist of a set of rubbers placed one beside the other on a common axle (Figure 1). The rolled surface area is not smooth. Rubber rollers are well suited for rolling after sowing because the rubber is flexible and fits the soil well [5]. They are simple to construct since the formers can make them by themselves without major financial investment. They can be used also in combined tools; in most cases they are combined with circular spike harrow. The smooth rollers successfully work on flat soil without trenches or ridges. Originally, they were made of wood; nowadays they are metallic, filled with water, sand or concrete (Figure 2). They consist of one or several cylindrical bodies. Multiple-part smooth rollers are fixed to a common yoke and are interconnected by chains. Smooth rollers compact the earth on the surface only, therefore often the crust is formed; further, they insufficiently join the ploughed soil with the non-ploughed soil. They are used to attract water to the seed; rolling by smooth rollers may be followed by harrowing to prevent unnecessary escaping of moisture into the air. Smooth rollers are used for establishing the capillary rise and not for compacting the ploughed soil. The working width of the edged roller was 2.20 m (Figure 3). By their sharp edges they crush the clods well and press them into the soil. Behind the edged rollers the surface area does not remain smooth, so there is no risk of the crust being formed. They prove to be useful also on uneven grounds.

## 3. Material and methods

### 3.1. Test

On 6. 7. 2003 we entered into a test on a field near Bistrica ob Sotli. The test was based on divided land lots in a random block. The test covered three types of rollers, inspection (without rolling) and three sorts. The entire test was executed in four repetitions. Sprouting on the fourth and sixth day after sowing was studied. Sowing and rolling were performed on the same day, i.e., 6. 7. 2003. After expiration of the sixth day there was no new sprouting, therefore, further counting of plants did not make sense. The split block diagram of the last is given in table 1 [6, 7, 8].

### 3.2. Ploughing, pre-sowing preparations and sowing

The buckwheat likes light, sand and clay soil. The produce on acid soil is worse than on the basic soil. On wet and through-manured soil the produce lies down, therefore it is not as

desirable. Immediate ploughing of the stubble field is very important for conservation of the soil moisture. After moderate manuring with manures and fertilizers including liquid manure [9, 10, 11, 12] the stubble field is ploughed 12 to 15 cm deep. For normal sowing ploughing is to be slightly deeper, namely 15 to 18 cm. Optimum depth of ploughing provides the conditions for correct development and growth of plants. To this end, own experience and the result of experiments, accurately performed by research institutions in the course of several years, are taken into consideration.



Fig. 1. Rubber roller



Fig. 2. Smooth roller



Fig. 3. Edged roller

Manuring can be affected also immediately after ploughing when, due to fast loss of moisture, the pre-sowing treatment of the soil is necessary. Of course, the buckwheat must not be sowed into dry soil [13]. For the experiment the following utensils were used: two-furrow double-turn plough (12 inches), soil preparation

machine, sowing machine for close sowing, edge roller, rubber roller of domestic make and smooth roller.

Table 1. Split block diagram

I.	V <sub>k</sub>	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>
	V <sub>3</sub>			
	V <sub>1</sub>			
	V <sub>2</sub>			
II.	V <sub>2</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>1</sub>
	V <sub>3</sub>			
	V <sub>k</sub>			
	V <sub>1</sub>			
III.	V <sub>1</sub>	A <sub>3</sub>	A <sub>1</sub>	A <sub>2</sub>
	V <sub>2</sub>			
	V <sub>3</sub>			
	V <sub>k</sub>			
IV.	V <sub>3</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>1</sub>
	V <sub>k</sub>			
	V <sub>1</sub>			
	V <sub>2</sub>			

Legend: A<sub>1</sub> - 'Bamby'  
A<sub>2</sub> - 'Darja'  
A<sub>3</sub> - 'Gorenjka'

V<sub>k</sub> - inspection (without)  
V<sub>1</sub> - edged roller  
V<sub>2</sub> - rubber roller  
V<sub>3</sub> - smooth roller

### 3.3. Ploughing, pre-sowing preparations and sowing

Previous tests had proved that the produce was identical when sowing 250 seeds per m<sup>2</sup> as well as when sowing 700 seeds per m<sup>2</sup>. For the field test a frame of 500 seeds per m<sup>2</sup> was selected. Sprouting starts on the day when distinctly sown rows are noticed. Counting of plants is a method of finding out the density of sowing. To this end, young plants on 1 m<sup>2</sup> area are counted by using a frame of 1 m time 1 m made for this purpose and placed onto the sown seed and by counting the plants within that frame. Figure 4 show the sort 'Gorenjka' in combination with rubber, smooth, edged rollers and inspection.

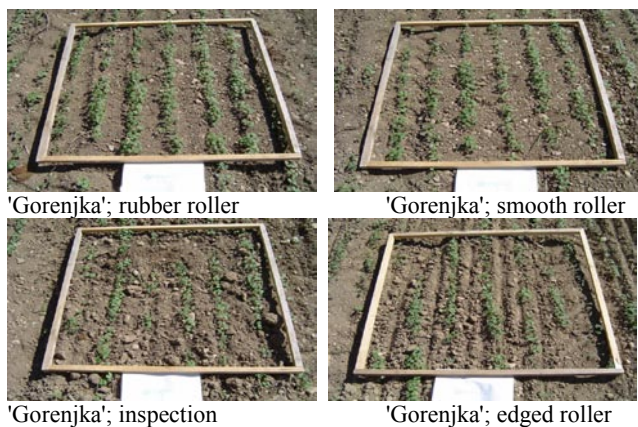


Fig. 4. Sort 'Gorenjka' by the use of different rollers and inspection [14]

## 4. Results with discussion

### 4.1. Influence of different rollers on different sorts of buckwheat

By statistical processing of data (Table 2) the influence of different rollers (edged, rubber, smooth) on different sorts of buckwheat ('Bamby', 'Darja', 'Gorenjka') was proved.

Table 2. Statistically characteristic differences of influences of three types of rollers on three different sorts of buckwheat [14]

Factor	n	4th day	6th day
Sorts - S	3	**	**
Rollers - V	3	**	**
S x V		**	**
Sorts			
A <sub>1</sub> - 'Bamby'		278 a	310 a
A <sub>2</sub> - 'Darja'		195 b	235 b
A <sub>3</sub> - 'Gorenjka'		296 a	332 a
Rollers			
K - inspection		208 b	235 b
V <sub>1</sub> - edged		276 a	307 a
V <sub>2</sub> - rubber		293 a	334 a
V <sub>3</sub> - smooth		249 b	292 ab

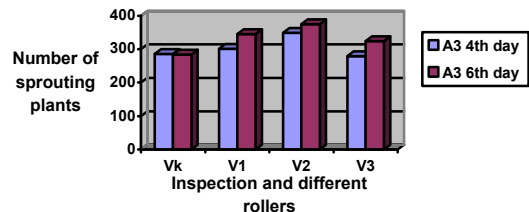
\*\* - significance with P ≤ 0.01

n.s. - not significant, no differences between

a, b - means market with different letters in column

The analysis of the variance shows that there are significant differences (P ≤ 0.01) between rollers and sorts. The sort (cultivar) statistically characteristically influenced the share of sprouting plants on the fourth as well as on the sixth day after sowing. From statistical processing it is evident that throughout the sort 'Gorenjka' had the highest share of sprouting plants; it must be considered that the sort 'Gorenjka' had also the highest germination index if compared with the other two sorts.

In case of 'Gorenjka' the germination index amounted to 95 %; it means that 475 seeds out of 500 seeds sown on 1 m<sup>2</sup> sprouted. According to statistical processing 296 seeds sprouted on the 4th day and 332 on the 6th day (Figure 5). The data refer to rolling with edged roller V<sub>1</sub>. Hence it follows that a little less than 70 % of plants sprouted.



V<sub>k</sub> - inspection, V<sub>1</sub> - edged roller, V<sub>2</sub> - rubber roller, V<sub>3</sub> - smooth roller

Fig. 5. Different rollers and inspection in case of sort 'Gorenjka' A<sub>3</sub> (4th and 6th day)

In case of the sort 'Bamby' the germination index amounted to 93 %; it means that 465 seeds out of 500 seeds sown on 1 m<sup>2</sup> should sprout. According to statistical processing 278 plants sprouted on the fourth day and 310 plants on the 6th day (Figure 6); it means that 66 % of plants sprouted.

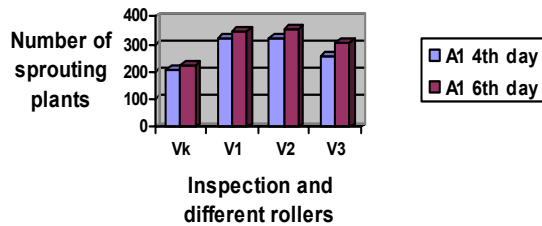


Fig. 6. Different rollers and inspection in case of sort 'Bamby' A<sub>1</sub> (4th and 6th day)

The sort 'Darja' had the lowest germination index (90 %) and also the sprouting rate was lowest, if compared with the other two sorts. Out of 450 seeds which should germinate, according to statistical processing 195 sprouted on the 4th day and 235 on the 6th day (Figure 7); it means that 52 % of plants sprouted.

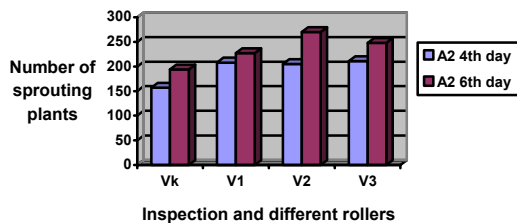


Fig. 7. Different rollers and inspection in case of sort 'Darja' A<sub>2</sub> (4th and 6th day)

The number of sprouting plants is characteristically influenced ( $P \leq 0.01$ ) also by the roller. Most sprouting plants appeared on the land lots rolled by rubber roller. On the fourth and sixth day sprouting on those land lots was greater for 30 % than on the non-rolled lots. On the lots rolled by edged roller there were 24.5 % more sprouting plants than on the non-rolled lots, while on the sixth day there were 23.5 % more of them. On the other hand, sprouting in case of smooth roller was the lowest, namely 16.5 % greater on the fourth day and 20 % greater on the sixth day than on the non-rolled areas. Hence it was concluded that the combination of the rubber roller and the sort 'Gorenjka' had proved to be the best [15].

## 5. Conclusions

Rolling after sowing becomes outstanding during the summer months when there is a shortage of moisture for germination. This applies particularly in the extremely dry summer as it was the case in the time of the experiment. Thus, the seed has the best chances to germinate.

Rolling is a specially important procedure in the soil cultivation. On the non-rolled land lots (inspection) there were least sprouting plants. The smooth roller proved to be the worst, whereas the rubber roller proved to be the best.

It adapts itself well to the soil and leaves the surface relatively smooth, whereas it does not require any considerable financial means for its manufacture. Consequently, the best combination is the rubber roller and the sort 'Gorenjka'.

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