# Bogballe Spreader Testing Using Croatia Produced Fertilizers

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## ABSTRACT

The paper presents the investigation results of the working quality of the Bogballe firm centrifugal spreader of the model designation ”L” (L2+). The trials were conducted in field conditions characterized by favorable weather in terms of the temperature (>18°C) and relative air moisture (< 60%). Mineral fertilizer packed in 25 kg sacks produced in Kutina in November 2008 was used in the trials. By the granular composition, NPK fertilizer had increased percentage of granules being 2.1 do 5 mm in diameters as opposed at UREA fertilizer. So, NPK fertilizer of the formulation 7:20:30 has 87.4%, unlike UREA having 69.8% granules of the aforesaid diameter. But UREA had 30.2% granules smaller than 2.1 mm in diameter. The trials were carried out with 8 $kmh^{-1}$ and distribution of 400 $kgha^{-1}$ NPK formulation 7:20:30, and 200 $kgha^{-1}$ of UREA fertilizer. After the granules have been weighed by the collected testing boxes, coefficient of the surface mass distribution of 6.6% was obtained with NPK formulation 7:20:30 and 12.6% with UREA fertilizer. Based upon achieved results, the Bogballe firm spreader of the model designation ”L” can be ranked first class and recommended for our land application

Key words: spreader, testing vessel, mineral fertilizer, granular composition, distribution coefficient

## 1. INTRODUCTION

Fertilizers are a significant means for achieving high and stabile yields in today’s crop production. In order to avoid great decrease of arable crops, more uniform fertilizer surface distribution is getting required. Uniform surface fertilizer distribution is possible to be performed by using quality spreaders and understanding of factors occurring in the course of their work. Former trials of the granule distribution quality have been done primarily in testing stations under strictly defined work conditions. Such conditions can not be provided during the working hours on the production area in the field, due to weather conditions. New centrifugal fertilizer spreaders are precise in diagonal and longitudinal distribution for achieving variation coefficient of 5-15%. Each machine manufacturer aims to shift variation coefficient of the diagonal

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granules distribution mass values into 5% zone. However, there are also significant differences in the work quality being the consequences of the diverse work speed, uneven granule-metric fertilizer composition, side wind speed and the like.

The trials aim to measure granule-metric fertilizer composition and determination of diagonal mass distribution of the fertilizer granules. It should result in understanding of the work quality of the new *Bogballe* firm spreader in field work conditions using fertilizers produced in Croatia.

## 2. MATERIALS AND METHODS

Vessels for determination of the surface fertilizer distribution were made of galvanized sheet metal of 0.6 mm thick on the model of the *Rauch* firm box from the testing set *Delta-Praxis*. It is common for such a type of investigation. The testing vessel is characterized by the work area of 0.25 $m^2$. In the course of the trial the measuring was conducted with 48 boxes placed diagonally to the spreader work direction.

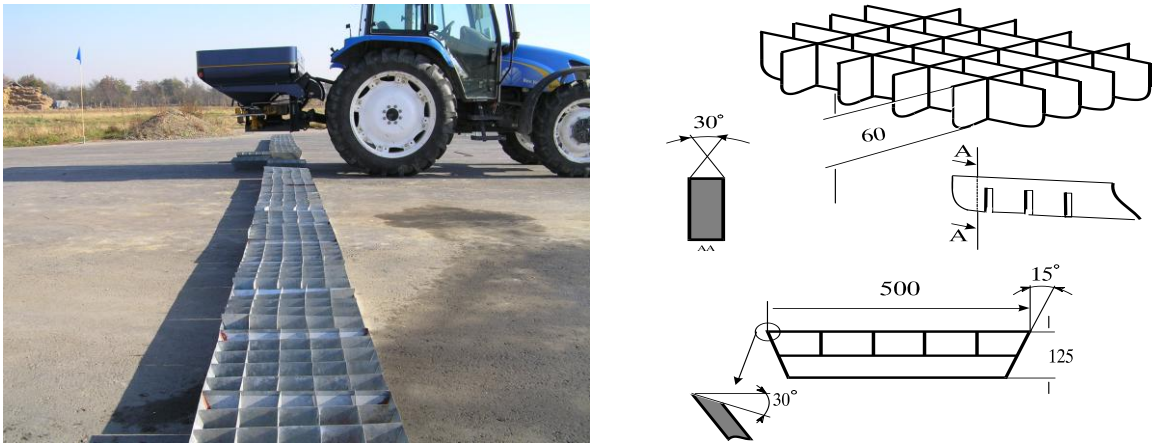


Figure 1. Position of the testing boxes in the course of the spreader checking with technical standards of fabrication in mm

Other part of the tasks was carried out with the common standard methods applied for such type of investigation. The spreader setting for testing was done by the service workers of the "*Findri*" firm being a spreader sale agent of the *Bogballe* firm for Croatia.

## 3. RESULTS

### 3.1. Weather Conditions at *Bogballe* Spreader Testing

Testing of the spreader of "L" series with adjusted work engagement of 18 m for NPK fertilizer and 24 m for UREA. Investigation was conducted at the beginning of April 2009. At the beginning of the investigation a relative air humidity was 58% and 52% at the end of the testing. Air temperature during the testing ranged from 18 to 19 $^{o}$. Circulating speed of soil parallel air was from 0.40 to 1.2 $ms^{-1}$ in the course of the testing *Bogballe* firm "L" series spreader. Changing of the testing box positions in terms of wind direction resulted in considerably less negative effect on granules surface distribution.

### 3.2. Results of Granule-metric Composition Value of the Applied Fertilizer

In Croatia complex fertilizers (NPK) should contain at least 95% of granules ranging 0.5 - 5 mm whereas UREA with 46% N should have 96% granules ranging 0.5 – 3 mm in diameter. Fertilizer granule-metric composition structure applied in the conducted spreader testing can be seen in Table 1.

From the above mentioned table, it can be seen that complex NPK fertilizer of the formulation 7:20:30 contains 87.4% granules 2.1 - 5 mm in diameter and only 4.9% granules below 2 mm in diameter. For UREA we can see that granules diameter from 0.5 to 3 mm was represent with 99.0%.

Table 1. Ratio of fertilizer granule size of NPK 7:20:30 and UREA 46% N

| **Fertilizer NPK 7:20:30** | | | | | | |
|---|---|---|---|---|---|---|
| Statistical measure indicators | Granules diameter ( mm ) | | | | | |
| | **7.1-10.0** | **5.1-7.0** | **3.1-5.0** | **2.1-3.0** | **1.1-2.0** | **< 1.0** |
| $\bar{x}$ **( % )** | 3.0 | 4.4 | 79.0 | 8.3 | 4.2 | 0.8 |
| ***S.d.*** | 0.283 | 0.252 | 0.992 | 0.801 | 0.342 | 0.129 |
| **C.v. ( % )** | 9.2 | 5.7 | 1.2 | 9.6 | 8.3 | 15.7 |
| **Fertilizer UREA 46% N** | | | | | | |
| Statistical measure indicators | Granules diameter ( mm ) | | | | | |
| | **7.1-10.0** | **5.1-7.0** | **3.1-5.0** | **2.1-3.0** | **1.1-2.0** | **< 1.0** |
| $\bar{x}$ **( % )** | - | - | 0,9 | 68,8 | 29,9 | 0,3 |
| ***S.d.*** | - | - | 0,31 | 2,58 | 2,61 | 0,10 |
| **C.v. ( % )** | - | - | 33,7 | 3,7 | 8,7 | 32,0 |

### 3.3. Results of the Fertilizer Surface Distribution Investigation

The best variation coefficient of the surface distribution of NPK fertilizer granules with the formulation 7:20:30 was accomplished at power unit speed of 8 $kmh^{-1}$ and fertilizer distribution of 400 $kgha^{-1}$ and he was 6.6%. UREA fertilizer application in the same conditions is characterized by the variation coefficient of 12.6% while spreading 200 $kgha^{-1}$ .

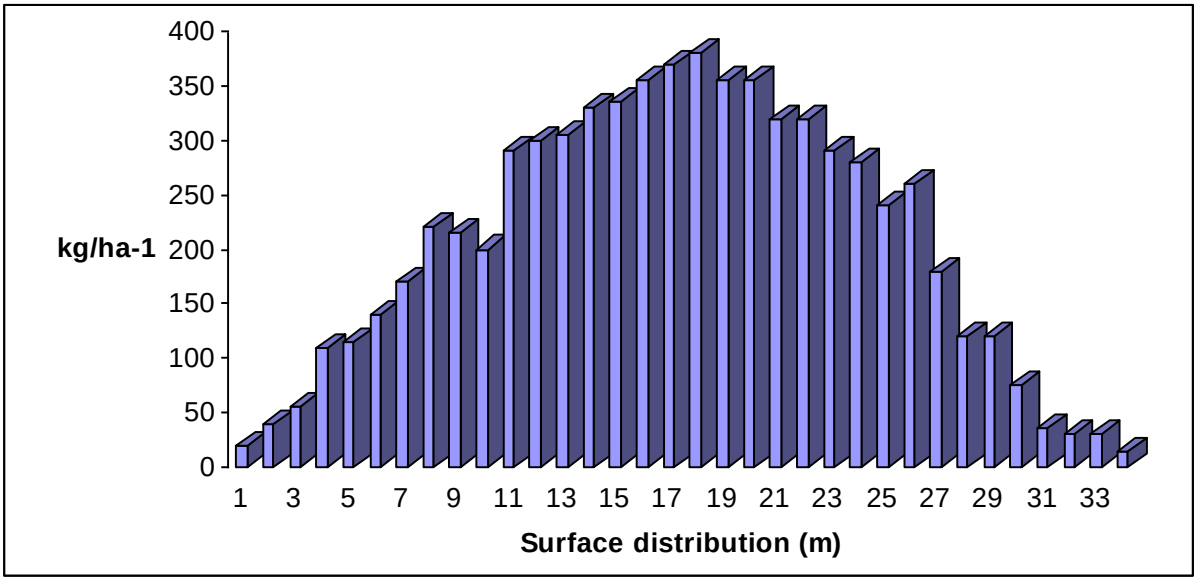


Figure 2. Surface distribution of NPK 7:20:30 fertilizer (C.v- 6.6%)

In general, we found very good surface distribution of fertilizer granules with spreading of 50.8 % out of the total mass on the right side and 49.2% on the left one of area supplied with the fertilizer. Distance of spreading granules in the conducted trials was 34 m (Figure 2).

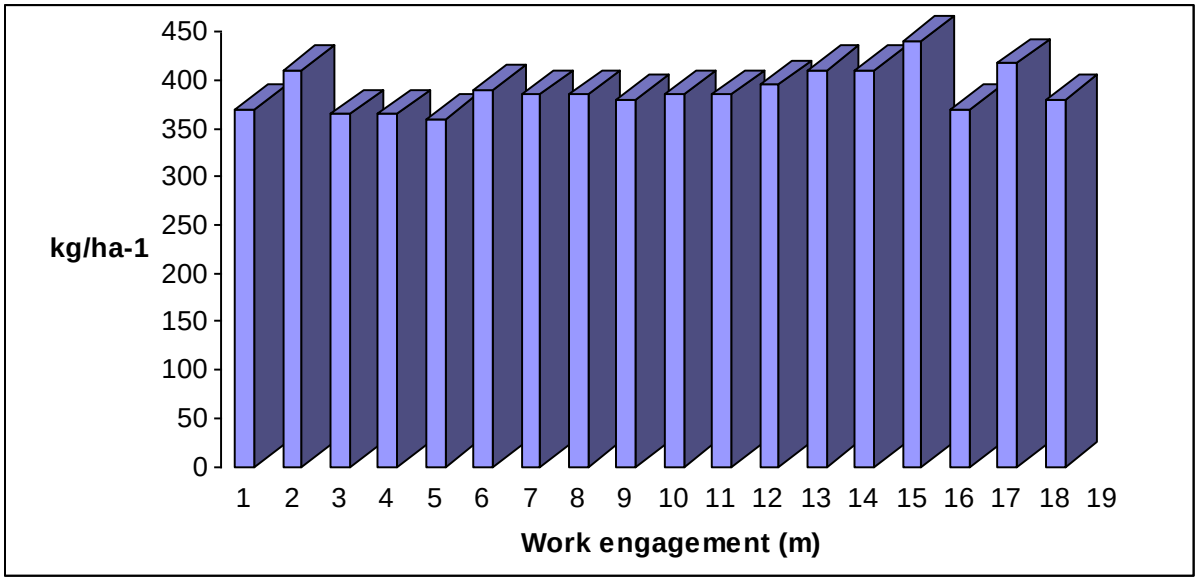


Figure 3. Total surface ratio of NPK 7:20:30 fertilizer granule mass depending on the spreader passing at the work engagement of 18 m

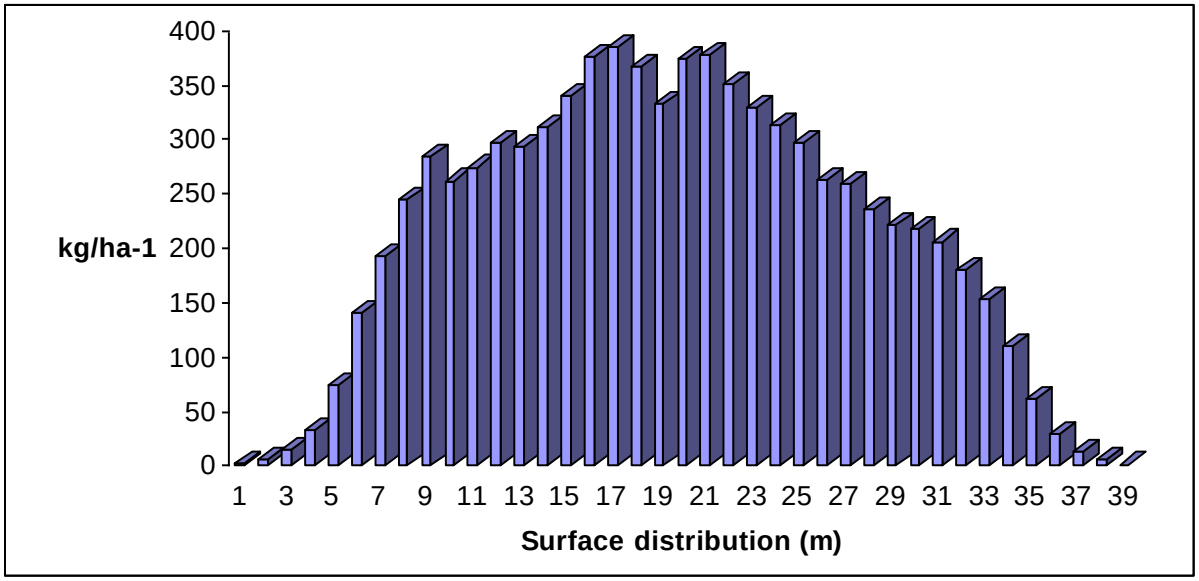


Figure 4. Surface distribution of UREA fertilizer with variation coefficient of 12.6%

First time in Croatia investigation for UREA work engagement was conducted on 24 m, and variation coefficient was 12.6%. This was managed with new scoops that were made especially for Croatian fertilizers in Bogballe factory in Denmark. This result is very good because previous investigations on work engagement for 18 m were above 15% of variation coefficient.

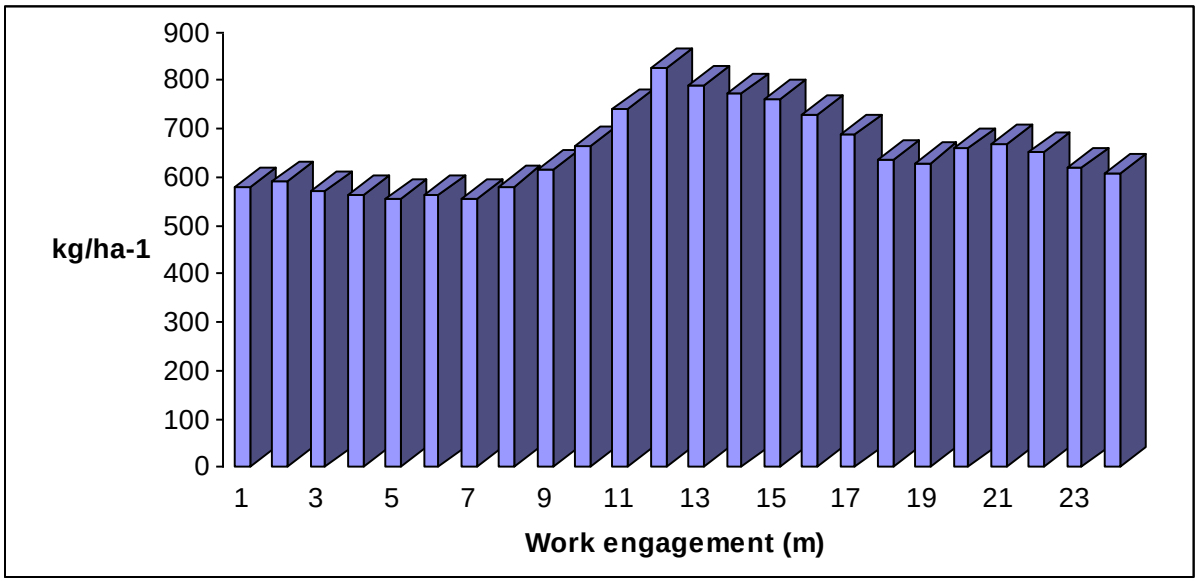


Figure 5. Total surface ratio of UREA fertilizer granules mass depending on the spreader engagement of 24 m.

## 4. CONCLUSIONS

Based upon the results of the conducted trials in terms of the work quality of *Bogballe* firm centrifugal spreader (model "L2+) the conclusions can be drawn as follows:

- Granule-metric composition of UREA 46% N fertilizer produced in Kutina indicates a significant ratio of granule fractions 0.5 – 3.0 mm (in diameter) of 99.0% of total fertilizer;
- Granule-metric composition of NPK 7:20:30 fertilizer produced in the same factory indicates that it is a uniform fertilizer with granules ( 2.1 – 5.0 mm) fraction ratio of 87.4% of total fertilizer;
- Surface distribution of NPK 7:20:30 fertilizer granules of mass 400 $kgha^{-1}$ at 8 km/h was accomplished with very low variation coefficient of only 6.6%, for spreader engagement 18 m;
- Surface distribution of UREA fertilizer granules of mass 200 $kgha^{-1}$ at 8 km/h was accomplished variation coefficient of 12.6%, for spreader engagement 24 m;
- Based upon the above data "L" *Bogballe* firm spreader can be characterized as one of the top quality spreaders.

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