7th INTERNATIONAL MULTIDISCIPLINARY CONFERENCE
Baia Mare, Romania, May 17-18, 2007
ISSN-1224-3264

EXAMINATION OF CONE-BELT DISPENSER

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ABSTRACT In probe parcels the more and more precise labour quality demands require mechanization of experiments. Distributing different types of fertilizer more accurately and evenly necessary in experimental plots. A solution is offered to mechanisation of distributing fertilizer on probe parcels. A new plot fertilizer distributor was designed and built. I am outlining the principle working of plot fertilizer. The unevenness of spreading of each type is significantly influenced by the aberration of the vertical angle position of the cone-belt dispenser. A test-bench was collected to measure the aberrations. The measurement prove, that only a few degree deviation results in significant change in the unevenness of dispensing

Keywords: plot, cone-belt dispenser, vertical angle

1. INTRODUCTION, LITERATURE

The increasing number of agrotechnical experiments and more precise labour quality demands require mechanization of experiments [4] [6]. While manufacturers offer a lot of machines for harvesting and seeding tasks, there is a little choice of plot machines for nutritive replacement tasks. A new plot fertilizer distributor was improved to solve the problem of the nutritive replacement tasks. It was sponsored by the Wintersteiger GmbH (Austria).

1.1. Examination the cone

The effect of cone angular deviation significantly influences the evenness of spreading. It was determined by Fleming [3] with seeds. He pointed out that uneven seed distribution in the cone results in uneven seeding rates along the plot, and it is further exacerbated if the ground is sloping.

Betzwar [1] investigated the cone too. He proved by measurements that the distribution of the kernels at the surface of the cones is influenced by inclination. When the cone is not horizontally levelled the granule concentration is unequal. However, inclinations higher than 3 % have a growing influence on the seed distribution in all cone systems.

2. MATERIAL AND METHOD

The improved plot fertilizer distributor principal detail is the cone-belt dispenser (figure 1). It is widely used from the 1980s, mainly for plot-seeders and for plot fertilizer distributors. Stumborg et al. [5] opinion is the following: the cone-belt dispenser is a useful device for dispensing sowing-seed.

2.1. The cone-belt dispenser

The granule is fed into the supply cylinder and collected on the head of the distribution cone. At the beginning of the plot the supply cylinder is lifted, and the granule is trickled down on the surface of the cone. Finally the granule is driven into the groove, located between the base of the cone and the rubber conveyor belt. The granule is moved by the rubber conveyor belt, driven by the cone. The cone with surrounding rubber belt must make one revolution depending on the length of the plot. The speed revolution of the cone can be adjusted by changing the sprockets between the ground wheel and the driven cone. There is a hole on the circle surface of the cone, where the granule can be flown out from the cone (Figure 1).

Figure 1: The cone-belt dispenser

2.2. Introducing the conditions of development and examinations

The examinations were carried out at the Education-Research Base of Department of Agricultural Mechanics.
The following fertilisers were used during the tests:

- NPK 15-15-15 (Agrolinz Agrotechnikalien GmbH)
- Salt of Linz (ammonium nitrate limestone 27 % N, Agrolinz Melanin GmbH)
- Potash (0-0-60 %, Tiszamenti Vegyiművek, Szolnok)
- Ammonium nitrate (34 % N, Nitrogénművek Rt. Pétfürdő)

2.3. Examination the cone-belt dispenser

The work quality would change for the worse; if the axis of cone dispenser was not vertical. Therefore, work quality examinations were made in case of different inclination angles. A test-bench was collected to measure the aberrations (Figure 2). The frame of the cone dispenser was adjusted horizontally. The laser angle-gauge (which was on the frame) was adjusted horizontally and was calibrated to the sign of 0^o on the wall. The frame of the cone can be adjusted in two directions by two levers of the eccentric wheel. The external part of the belt of the cone dispenser was separated into 12 segments (I tested the appliance by modelling of a 6 m long plot, so one segment was 0.5 meter). An exactly determined quantity of fertilizer was filled into the supply cylinder, then the cone was turned over and 12 sample of fertilizer were taken. The quantity of fertilizer was measured with 4-type of fertilizer (the accuracy of the balance was 0.1 g). The adjusted aberration angles of the cone were the following: 1^o; 2^o; 3^o; 4^o; 5^o. The supplied quantity of fertilizer was 216 g. I tested the appliance by modelling of a 6 m long and 1.2 m wide plot, so the fertilizer volume was 300 kg/ha.

Figure 2: Examination of cone-belt dispenser

One of the most essential interrelations for determining the unevenness of spreading is the variety factor [2].

$$CV = \frac{100}{\bar{x}} \sqrt{\frac{\sum_{i=1}^{n} \left(x_i - \bar{x} \right)^2}{n-1}} \quad (1)$$

where:

- x_i – the average amount of collected fertilizer at a certain test place during three measurements
- $\bar{x}$ – the average amount of collected fertilizer at all test places during three measurements
- n - the number of test places

3. RESULTS AND EVALUATION

As far as my experience goes, the cone-belt dispenser is a useful device for distributing fertilizers, because there is no rubbing effect between the cone and the belt, and the exit hole is not clogging about the mass of fertilizer. The following advantages and disadvantages were revealed by the tests.

Advantages:

- An exact distribution of the desired quantity of fertilizer is obtained.
- An even distribution is assurable.
- The shape of the granule is irrelevant to the precision of distributing.
- A relatively small amount of fertilizer can be distributed also.
- Precise quantities of fertilizer are required.

Disadvantages:

- Work difficulties arise if the plot lengths more than 10 m.
- The quantity of fertilizer must be exactly determined.
- The position of the machine must be absolutely horizontal.

I demonstrated the mass of 216 g fertilizer located between the base of the cone and the rubber conveyor belt (Figure 3) in two causes. The first when the axis of the cone was vertical (on the left side of Figure 3), and the second case if there were 5 degrees between the vertical line and the axis of the cone (on the right side of Figure 3).

Figure 3: The fertilizer on the vertical and on the not vertical cone

The cone-belt dispenser was examined with 4-type fertilizer. The mass of fertilizer was 216 g (Figure 4).

Based on the examination it can be stated the followings:

- Different types of fertilizers are dispensed in the same way when the axis of the cone is not vertical.
- A relatively small amount of fertilizer makes relatively larger aberration of dispensing.
- The measurement prove, that only a few degree deviation results in significant change in the unevenness of dispensing
- The measured dates with fertilizer were confirmed by the results of Fleming [4] experiences with seeds.

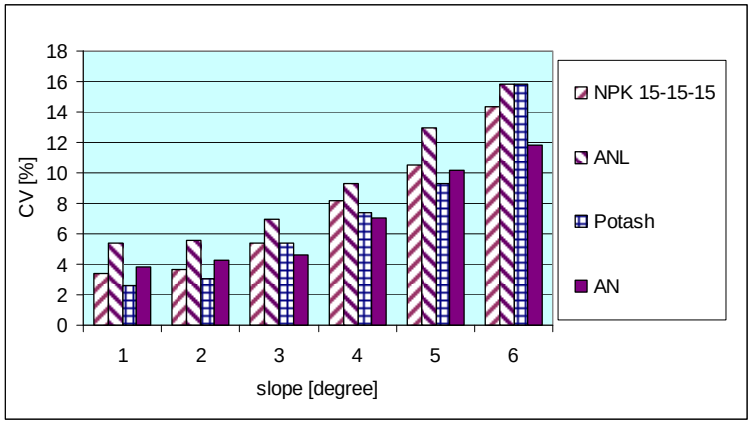

Figure 4: Result of examination the cone-belt dispenser

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