

Experimental Researches of the Cone-Belt Dispenser

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

Keywords: plot, cone-belt dispenser, vertical angle

INTRODUCTION

While manufacturers offer a lot of machines for harvesting and seeding tasks, there is little choice of plot machines for nutritive replacement tasks. The increasing number of agro-technical experiments and the more precise labour quality demands require mechanization of work. A new plot fertilizer distributor was developed to solve the problem of the nutritive replacement tasks. The present study was sponsored by the Wintersteiger GmbH (Austria).

Betzwar, 1992 investigated the cone. 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 leveled the granule concentration is unequal. However, inclinations higher than 3 % have an increasing influence on the seed distribution in all cone systems.

The effect of cone angular deviation significantly influences the evenness of spreading. It was investigated by Fleming, 1984 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.

Stumborg et al., 1992 opinion is the following: the cone-belt dispenser is a useful device for dispensing sowing-seed.

MATERIALS AND METHODS

The principle of the improved plot fertilizer distributor is the cone-belt dispenser (Fig. 1). It is widely used from the 1980s, mainly for plot-seeders and for plot fertilizer distributors.

The Hege-type cone-belt dispenser: At the beginning of the plot - when the process starts - the supply cylinder is lifted, and the particles fall down on the surface of the cone. The granule is fed into the supply cylinder and collected on the head of the distribution 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 on the full 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 particles discharge from the cone (Fig. 1).



Fig. 1. The cone-belt dispenser



Fig. 2. Examination of the cone-belt dispenser

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)

A test-bench was set up for the experiments (Fig. 2). The work quality can be spoiled, if the axis of the cone dispenser is not vertical. Therefore, work quality examinations were made in case of different inclination angles. 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° 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 modeling of a 6 m long plot, so one segment was 0.5 meter). A given amount of fertilizer was filled into the supply cylinder, then the cone was turned over and 12 fertilizer samples were taken out.

The quantity of fertilizer was measured with four types of fertilizers (the accuracy of the balance was 0.1 g). The adjusted tilt angles of the cone were set as follows: 1°; 2°; 3°; 4°; 5°. The supplied quantity of fertilizer was 216 g. I tested the appliance by modeling a 6 m long and 1.2 m wide plot.

The definition of the unevenness of spreading gives CV as the variety factor.

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

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
- (Csizmazia, 1993)

RESULTS AND DISCUSSIONS

My test experiments demonstrated that, 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 present tests.

Advantages:

- The shape of the granule is irrelevant to the precision of spreading.
- A relatively small amount of fertilizer can be distributed.
- Precise quantities of fertilizers are required.
- An exact distribution of the desired quantity of fertilizer is obtained.
- Even distribution is possible.

Disadvantages:

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

I measured the mass of 216 g fertilizer located between the base of the cone and the rubber conveyor belt (Fig. 3) in two cases. First when the axis of the cone was vertical (on the left side of Fig. 3), and second, when there were 5 degrees between the vertical line and the axis of the cone (on the right side of Fig. 3).

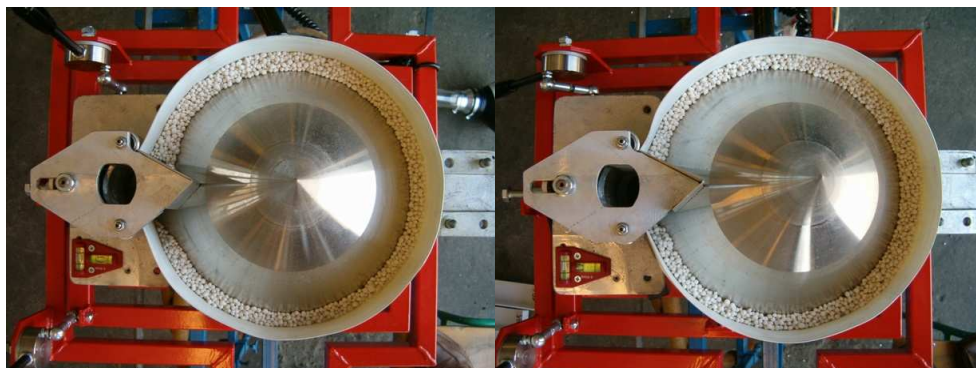


Fig. 3. The fertilizer on the vertical and on the not vertical cone

The cone-belt dispenser was examined with four types of fertilizers. The mass of fertilizer were 72 g and 216 g (Fig. 4).

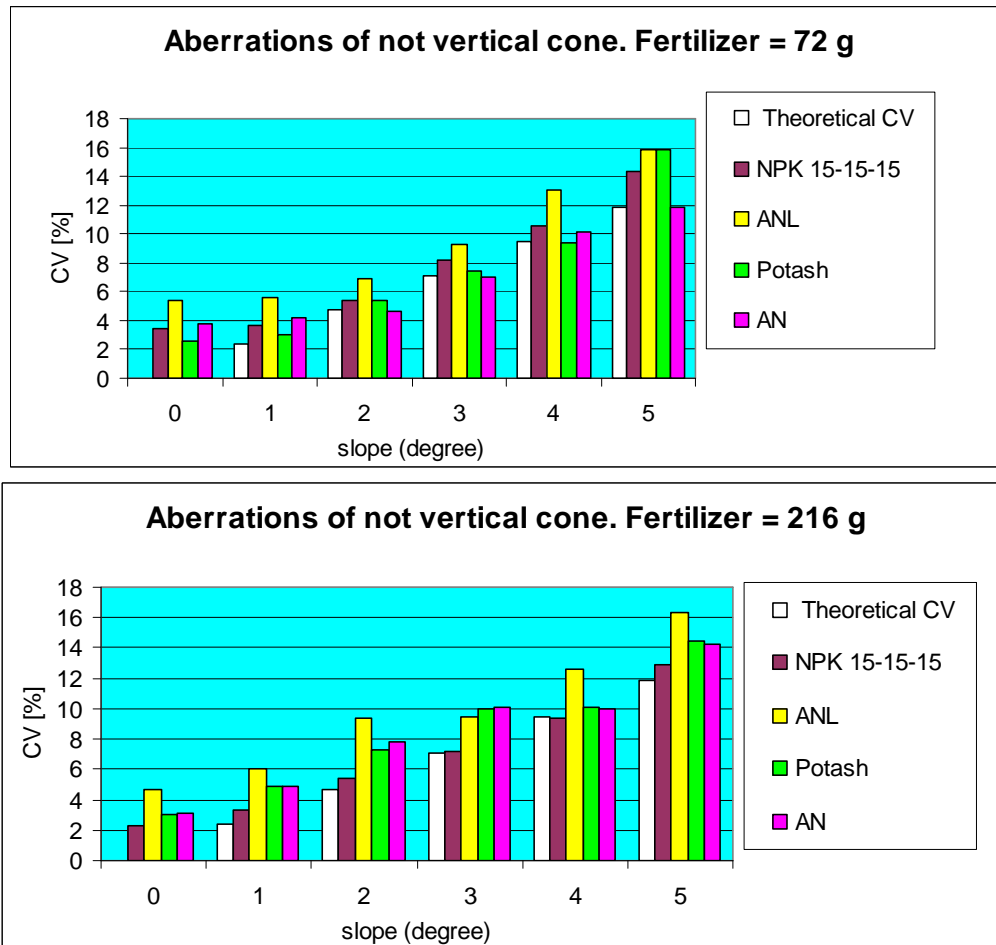


Fig. 4: Result of examination the cone-belt dispenser

CONCLUSIONS

The measurement proved, that a few degree deviations from vertical caused in significant change in the unevenness of dispensing.

The measured data with fertilizers are comparable to the results of Fleming, 1984 with seeds.

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 deviation of dispensing.

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