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 mechanisation 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 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

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 [4]. 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).

1.1. Examination the cone

Betzwar [1] 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 levelled 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 [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.

Tiba [6] dealt with the examination of vibration in agricultural machines.

Stumborg et al. [5] opinion is the following: the cone-belt dispenser is a useful device for dispensing sowing-seed.

2. MATERIAL AND METHOD

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

2.1. 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 (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

A test-bench was set up for the experiments (Figure 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^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). 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^o; 2^o; 3^o; 4^o; 5^o. The supplied quantity of fertilizer was 216 g. I tested the appliance by modelling a 6 m long and 1.2 m wide plot.

Figure 2: Examination of the cone-belt dispenser

The definition of the unevenness of spreading gives CV as the variety factor [2].

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

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

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 (Figure 3) in two cases. First when the axis of the cone was vertical (on the left side of Figure 3), and second, when there were 5 degrees between the vertical line and the axis of the cone (on the right side of Figure 3).

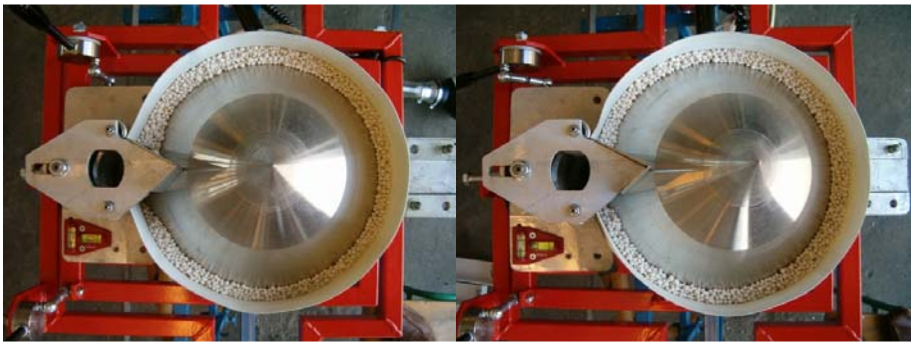

Figure 3: The fertilizer on the vertical and on the not vertical cone

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

Based on the examination I conclude the followings:

1. The measurement proved, that a few degree deviation from vertical caused in significant change in the unevenness of dispensing
2. The measured data with fertilizers are comparable to the results of Fleming [4] with seeds.
3. Different types of fertilizers are dispensed in the same way when the axis of the cone is not vertical.
4. A relatively small amount of fertilizer makes relatively larger deviation of dispensing.

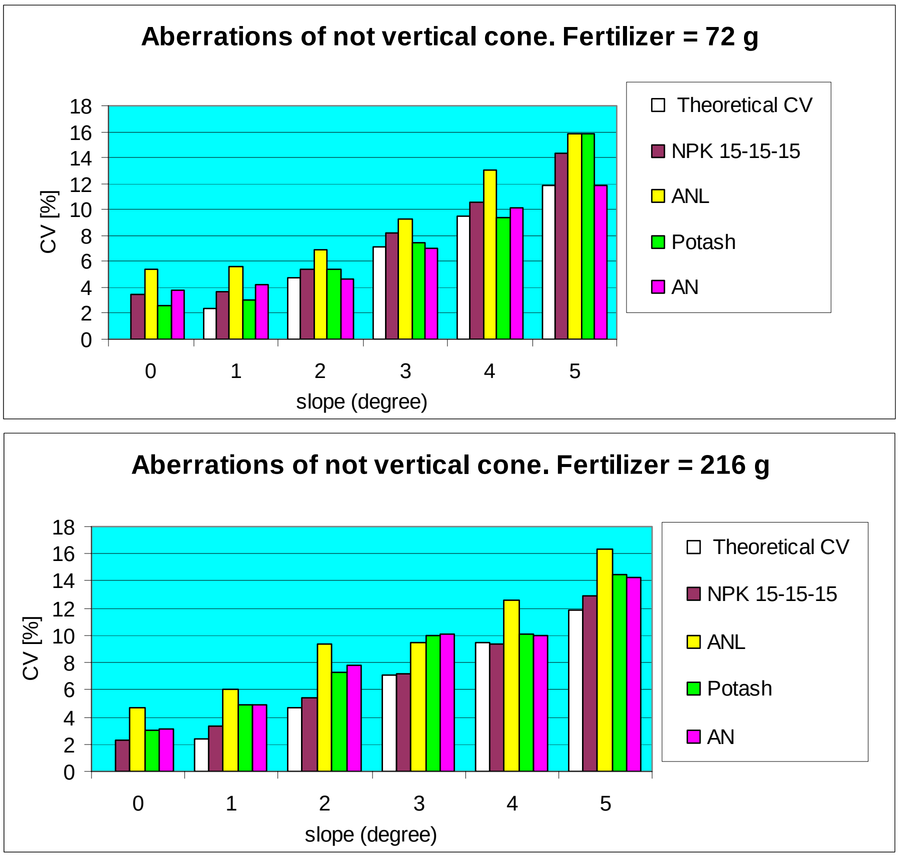

Figure 4: Result of examination the cone-belt dispenser

4. LITERATURE

[1] Betzwar, W. A method for the evaluation of seed distribution of plot seeders and precision spaced planters. Proceedings of the Eight International Conference on Mechanisation of Field Experiments Soest, Germany. 1992. 68-82.

[2] Csizmazia Z. Technical Conditions Of Equalized Fertilizer Applications. Hungarian Agricultural Research, 1993/12. 16-22.

[3] Fleming, J. J. Modifications to the Oyjord seed drill. Proceedings of the Sixth International Conference on Mechanisation of Field Experiments Dublin, Ireland. 1984. 63-70.

[4] Kunsági F. A gabonafélék szántóföldi kisparcellás gépesítésének fejlesztési lehetőségei különös tekintettel a tápanyag visszapótlásra, Szakmérnöki Diplomaterv, Gödöllő. 1988.

[5] Stumborg, M. A. – Mc Crystal, G. E. – Cowell, M. Design of a Casette Air Seeder for Breeder Plots. Proceedings of the Eight International Conference on Mechanisation of Field Experiments Soest, Germany. 1992. 56-61.

[6] Tiba Zs. Bestimmung der Bewegungsgleichung von Allgemeiner Antriebskette. Manufacturing Engineering University of Technology in Kosice 1. 2005. 23-26.

A KÚPOS-SZALAGOS SZÉTOSZTÓ

Kisparcellás kísérleteknél fontos az agrotechnikailag előírt pontos és egyenletes műtrágyaadag kijuttatása parcellánként. A kísérleteknél az egyre precízebb munkaminőségi követelmények megkövetelik a munkaműveletek gépesítését. A feladat gépesítésére egy megoldás lett kifejlesztve. Röviden ismertetem a tervezett és megépített berendezés fő részeit, működési elvét. Mindegyik típus szétosztási egyenlőtlenségét nagyban befolyásolja az osztókúp szimmetria tengelyének az eltérése a függőlegestől. Az osztókúp szöghelyzet hibájának méréséhez egy mérőpad készült. A mérések azt bizonyítják, hogy már néhány fokos szög eltérés a függőlegestől is jelentős változás idéz elő a szétosztás egyenetlenségében.