INNOVATIONAL PROPOSALS FOR THE SPCC-6 PLANTER ON THE BASIS OF THE EXPERIENCES ON FIELD IN HUNGARY

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Abstract: *Among the cultivations of plants maybe the most essential operation is the seeding. It's important to get the seed in optimal time, depth, quality and quantity in the seedbed. In our research we examined the SPCC-6 seeder under working conditions. We disclosed the reason of the failure of fan and planting unit. We created some innovational proposals for inhibiting the failures. We are sure that this machine can be a reliable and modern seeder by realizing the prepared proposals.*
Key words: *planter, fan, planting unit, measure*

1. INTRODUCTION

Among the cultivations of plants maybe the most essential operation is the seeding. It's important to get the seed in optimal time, depth, quality and quantity in the seedbed. If the seeding isn't appropriate — by the first operation — we can lose the 10-20% of the yield. Therefore is a very high need for reliable seeders.[2.]

In this work we examined the SPCC-6 pneumatic six row planter under working conditions. About the experiences on the field we made two modifications to make the seeder more reliable and more suitable for the operational conditions in Hungary. We changed the fan and the construction of the planting units. These modifications don't raise the price of the machine too much, because one of the strengths of this machine is the good price position on the market.

2. FIELD EXPERIENCES

By the test-seed on the field we noticed that from the seed tank 15-20% less seed decrease than the adjusted mass from the operation manual. The optical seed-control monitor doesn't

gave any signal. It may be concluded that the machine miss every fifth seed. And the monitor doesn't recognize this because the seed-disks are turning with high speed. Another experiment proved this right. We tried the seeder on the hard ground where the coulter can't form the seedbed, and the seeds were over the ground. It was easily to see where the seed was left out. This proved that on the sowed field the come up of the corn was imperfect.

First we controlled the seed eliminator, and the fit of the vacuum-housing with the seed-disk, but there was no failure. In this way the reason for the failure was traceable to the malfunction of the fan.

On the field we found an other fault of the machine by the controlling of the seedbed quality. The seedbed closing wheel doesn't density the seedbed with the right degree. The right density is very important, because in a loose seedbed the germination starts later and the plant will left out too late. We decided to make some changes on the planting units.

3. EXAMINATION OF THE FACTORY-MADE FAN

The engineers of the planter choose the best fan construction from the viewpoint of the manufacturing process, because the fan is very simple and easy to make. The whole fan is made from steel-plate with spot welding and screwing. The impeller has backward-curved blades. The ordered PTO revolution is 540rpm. The impeller gets the driving trough a belt drive.

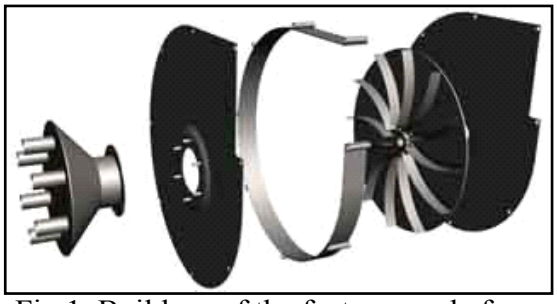

Fig.1. Build-up of the factory-made fan

To find out what is failure of the fan we choose to determine the characteristic lines. This is just possible with the measure of the fans depression and the speed of the flowing fluid. From these values and from geometrical data the characteristic have to count. [5.]

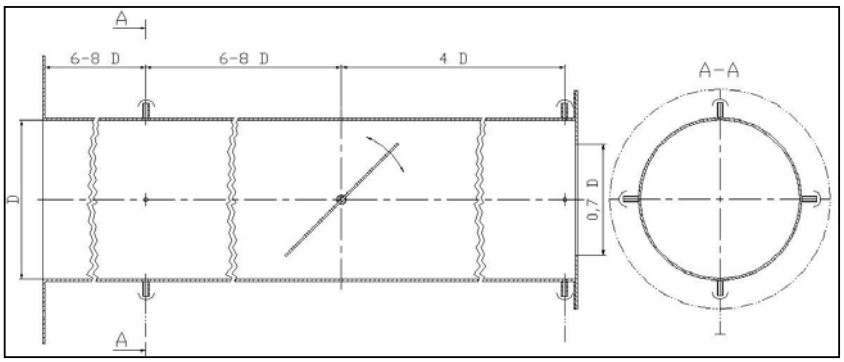

Fig. 2. Plan of the measuring canal

To measure the right values with high precision we had to plan the optimal measuring canal (Fig.2.). For measuring the pressure differences we made two liquid manometers filled with absolute alcohol.

The examination was made with an MTZ-82 tractor, by three PTO revolutions (540rpm, 640rpm, 750rpm). Every measuring was repeated three times to get the characteristic curves precisely.

After the measuring process with the received data we could determine the characteristic curves at the three PTO revolutions with the following equations:

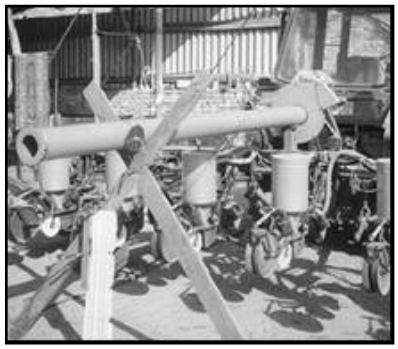

Fig. 3. The measurement

From the measured liquid columns the pressure difference is:

(1.) $$\Delta P=(\rho fluid - \rho_{air})g*h$$

The volume flow:

(2.) $$q_v=0,6*(d^2\pi/4)* \sqrt{2/\rho_1} * \sqrt{\Delta P_{mp}}$$

The density of the air:

(3.) $$\rho_l=P_{atm}/287*T\ [K]$$

The total pressure rise:

(4.) $$\Delta P_{all}=P_2+(\rho/2)v_2^2-P_1-(\rho/2)v_1^2=P_e+(\rho/2)*(v_2^2-v_1^2)=P_e+(\rho/2)*q_v^2*((1/A_2^2)-(1/A_1^2))$$

where A_1 and A_2 are the output cross-sections of the canals and fans. [3.]

From the measured and counted values the characteristic curves are drawable.

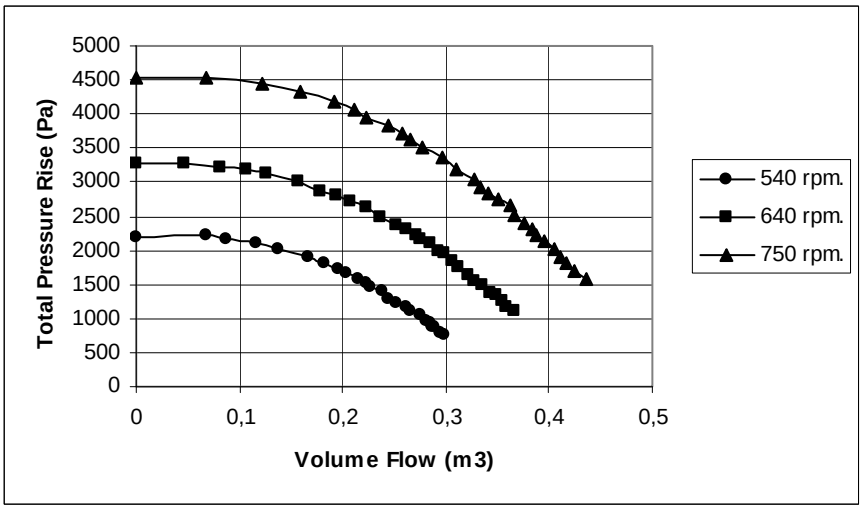

Fig. 4. Characteristic curves of the factory-made fan

Fig. 4. shows the characteristic curves of the factory-made fan. The reason of the failure is immediately noticeable. The sense of the lines shows a very falling characteristic. Because

every seed has a different form, the airflow never stops, indeed it continuously alternate. This characteristic results that a relatively small change of the volume flow involves a relatively high change of the total pressure rise. Because of this the less the seeds fill the holes of the seed-disks, the less will be the depression, and the seeds will fall down from the seed-disk.

4. THE DEVELOPMENT AND THE CONTROLLING OF THE NEW FAN

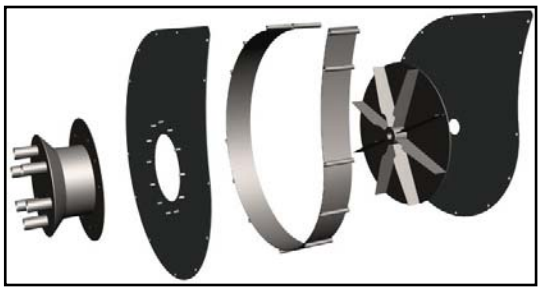

Fig. 5. Build-up of the new fan

By the development of the new fan the two important considerations were that the new fan doesn't raise the price of the machine high, and it doesn't need a great change by the drive. First we looked for an impeller that could be bought by every agricultural parts-store. We found an impeller that is the spare part of another pneumatic planter, but it has line-shaped blades and it's wider than the old one. We made a new housing that's build-up corresponds with the old SPCC fan-housing, but the dimensions are different (Fig. 5.). We don't changed the drive, but we raised up the PTO revolution from 540rpm to 750rpm. It means that the seeding with the MTZ 80/82 tractor have to be made with the 1000rpm PTO set and with a motor revolution of 1600-1700rpm. These setting affects the lifetime of the motor favorably.

We mounted the new fan on the seeder and accomplished the measure that we have done by the old fan. The characteristic lines of the new fan (Fig. 6.) are very different from the old one.

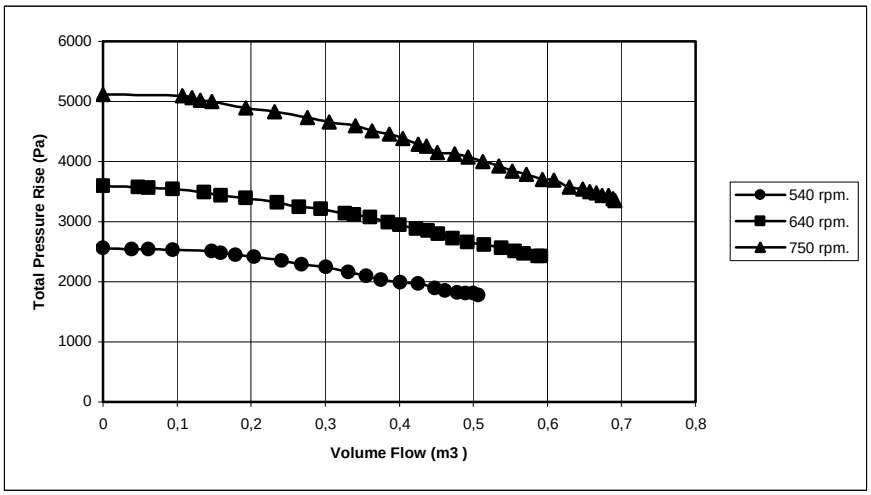

Fig. 6. Characteristic lines of the new fan

By the new fan the sense of the lines shows a less falling characteristic. Therefore the change of the volume flow doesn't involve a high change in the depression. The graph shows also that the depression is higher as it was by the old fan. Every time by every volume flow the fan produces optimal depression. In practice the seeds-disk pick up the seed surely and because of the shocks the seeds don't fall from the seed-disk.

5. CHANGING THE PLANTING UNITS

The failure of the planting units was that the density of the seedbed wasn't optimal. The seedbed has the optimal quality when around the seed the soil is more compact than above the seed[2.]. By many seeders the seedbed closing wheels are canted. With this construction the seedbed will be almost optimal because these wheels are putting the seed nearly from the side. This construction can't be applied by the SPCC because this would need a very great change on the planting unit. Some manufacturers use a wheel that roll in the seedbed and push the seeds into the hard soil. With this wheel the soil around the seed will have a high density and the seedbed will be optimal. We decided to mount a seed press wheel on the seeder to examine what positive changes can be reached in the quality of the seedbed and in the germination. To mounting of the wheel we must lengthen the frame of the planting unit. We developed the suspension of the wheel that the optimal press can be adjusted with the set of the spanner springs input tension in three units. Whit this wheel maybe we can attainable the optimal seedbed where the seed can easily pick up water and the plant can easily come up.

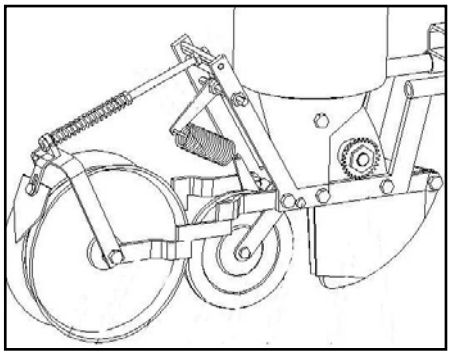

Fig. 7. The installed seed-press wheel

6. FIELD TESTS

We tried the modified seeder with the new fan and the seed press wheel on the field in operation. The test showed that with the new fan the planting is very even. The seed disks don't loose the seeds.

By the controlling the seedbed quality we recognized that the seed press wheel is doing a good job, because the wheel press almost all of the seeds in the seedbed. In the test year was enough rainfall and the soil was enough wet to provide optimal conditions for the

germination. The real importance of this construction is noticeable when not enough rain falls, and the seed can't pick up enough water.

7. CONCLUSIONS

This study work was started with the next two intentions:

- to analyze of the factory-made fan, and solving the problem;
- to change the structure of the planting unit for improving the seedbed.

The two intentions were solved. It was confirmed with measures that the factory-made fan isn't suitable for this seeder. A new fan was created. Other measures and the field test proved, that the new fan of the seeder complies with the requirements.

The seed press wheel increases the quality of the seedbed. It ensures high density for the soil around the seed. In this case the seed can pick up more water, and this means that the germination starts faster.

We think, that these innovational proposals make the SPCC-6 a more reliable and modern seeder.

8. REFERENCES

[1.] Bánházi - Koltai - Soós: A szántóföldi munkagépek működésének elméleti alapjai Budapest. Mezőgazdasági Kiadó, 1984.

[2.] Dr. Fűzy József - Mészáros Győző: Kukorica szemenkénti vetőgépek Mezőgazdasági Technika, Gödöllő, 1998

[3.] Dr. Lajos Tamás: Az áramlástan alapjai, Budapest. Műegyetemi Kiadó, 2000.

[4.] Mészáros - Sitkei - Kégl: A mezőgazdasági gépek vizsgálata, Budapest. Akadémia Kiadó, 1965.

[5.] Dr. Pattantyús Á. Géza: Gyakorlati áramlástan, Budapest. Tankönyvkiadó, 1951.