STUDIES AND RESEARCHES ON TILLAGE MACHINES

STUDII ŞI CERCETĂRI PRIVIND MAŞINILE PENTRU LUCRĂRILE SOLULUI

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Abstract: *The paper refers to those mechanical soil- manipulating actions that nurture crops. Some researches are made on different types of plows: mouldboard plows, disk plows, middle-breakers. The experiments refer to the effect of hard surfing on wear and draft of 35 cm flat expendable shares in dry sandy loan-soil. There also are considerations made on disk plow adjustments and sub-surface tooling adjustments. The material used is mainly the plow in different types and the method consists in direct measurements of certain parameters in order to make diagrams and to achieve different adjustments. The originality of the paper consists in the experiments made by author on different tillage machines.*

Rezumat: ***L****ucrarea se referă la acele acţiuni de manipulare mecanică a solului care asigură recoltele. Unele cercetări sunt făcute pe diferite tipuri de pluguri : pluguri cu trupiţe, pluguri cu discuri şi subsoliere. Experimentele se referă la efectul suprafeţei dure a solului asupra rezistenţei întâmpinete pe fâşii de 35 cm de sol nisipos. De asemenea, sunt făcute consideraţii asupra reglajelor plugurilor cu discuri şi asupra subsolierelor.Materialul utilizat este îm principal plugul de diferite tipuri şi metodele constau în măsurări directe a anumitor parametrii pentru realizarea diagramelor şi pentru realizarea reglajelor. Gradul de originalitate al lucrării constă în experimentele făcute de autoare pe diferite maşini de lucrări ale solului.*

Key words: *tillage machines, plows*
Cuvinte cheie: *maşini pentru lucrările solului, pluguri*

INTRODUCTION

Tillage has been defined as those mechanical-soil manipulating actions that nurture the crop. The nurturing objective is one of developing a desirable soil structure that promotes seed germination, plant emergence and root growth. Nurturing also requires inhibition of competing weeds and over-seeded plantings.

Conventional tillage describes the system where crop residues are disposed of by chopping and incorporating into the tilled soil layer. Such a tillage system has a high energy, primary tillage operation followed by a later secondary tillage to kill sprouted weeds and prepare a seed bed for a subsequent seeding. Weeds were controlled by deep plowing and mechanical cultivation.

Reduced tillage refers to any system that requires less soil manipulation than a conventional system used for comparison. The tillage objectives save tractor fuel and time when unnecessary and unproductive tillage operations are eliminated. Combined operations into a once-over trip, strip tilling only the planned rows and tilling only as deep as is productive are actions to reduce tillage energy and the cost of production. Chemical weed control may be required.

Conservation tillage is defined as a system that places a premium on reducing soil loss. On highly eroding soils, conservation tillage procedures are necessary. The objectives include both wind and water erosion. Maintaining a soil cover with previous crop residues or producing a soil surface of dense clods meets this objective. Weed control is dependent on chemical herbicides.

MATERIAL AND METHOD

Experiments made on tillage machines

Tillage absorbs over half of the power expended on the farms.

Mouldboard plows are primary tillage implements consisting of warped surfaces equipped with cutting edges that crumble and invert the soil. This implement gives best residue coverage and superior pulverization under ideal conditions. A two-way plow maintains a level field and is used where flood irrigation is important. They are very applicable to plowing contours or terrace fields. Their ability to return down the furrow just completely eliminates dead furrows, back furrows and lost time in finishing irregular lands.

Disk plows do not cover crop residues as completely as mouldboard plows do. They are used where the soils are extremely hard or loose, rocky or having many roots, poor scouring and highly abrasive.

Middle breakers are listers without planting attachments. The bottom appears to be right and left-hand mouldboard plow bottoms joined at their landsides. These implements are used in soils with poor internal drainage to make ridges or beds in which to prepare a seed bed.

Subsurface tillage implements rip and pulverize soil without inverting it. They are used where residue coverage is not desirable. They are effective in preventing both wind and water erosion.

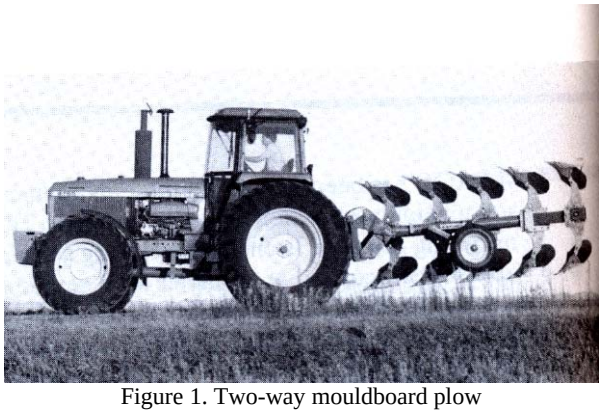

Figure 1. Two-way mouldboard plow

In fig.3 are presented the component parts of a typical mouldboard bottom plow equipped with gunned shares. It can be observed that the shape of a mouldboard bottom is a compromise among the factors of draft, completeness of inversion, pulverization or break-up of the furrow slice, burying of crop residues and scouring.

Figure 2. Tractor mounted middle breaker

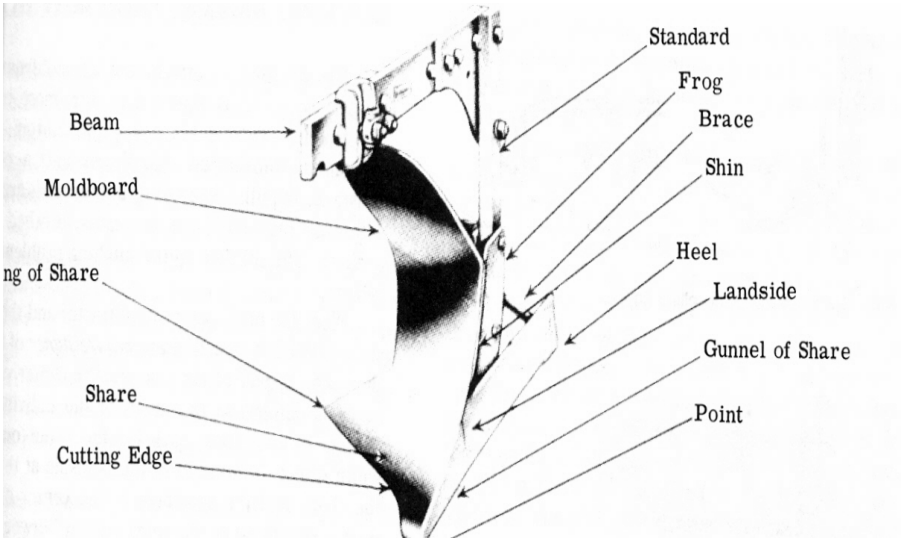

Figure 3. Rear bottom of a moldboard plow

The amount of wear on shares has some effect on unit draft. One of the experiments were made on the effect of hard surfacing on wear and draft of 35 cm flat expendable shares in dry sandy loam soil. For worn shares, the draft increased and the suction force decreased as compared to new shares

These data show that wear has only a minor effect on draft, but a great affect on suction and penetrating ability of a share. It was observed a decrease of the suction force with use.

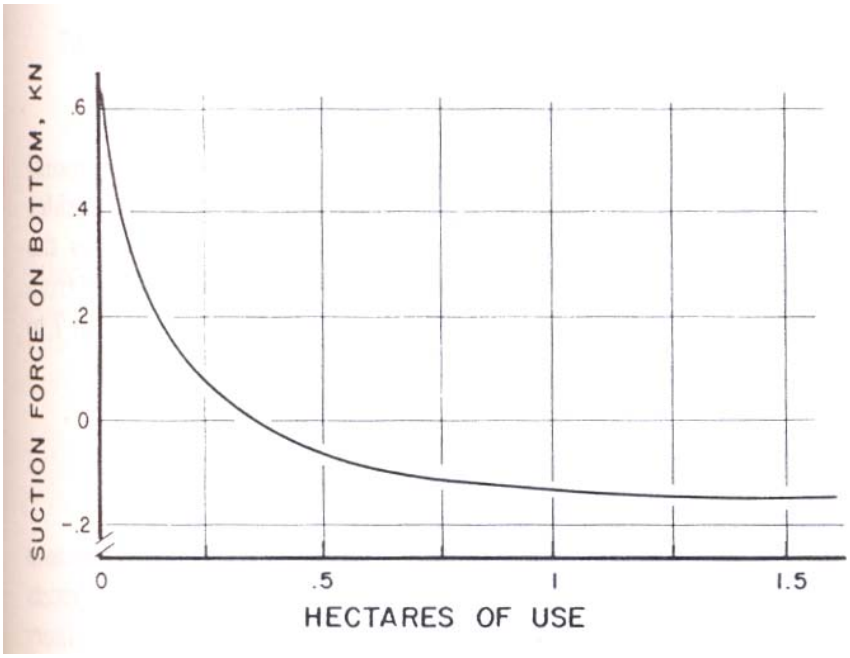

Figure 4. Effect of wear on penetrating ability of expendable shares

Tillage machines adjustments

Disk plow adjustments

Disk plow adjustments are somewhat different from those made for moldboard plows, because disk plows have no landside and thus must absorb more of the side-thrust of the soil on their wheels than moldboard plows. Pull-type plows have provisions for adjusting the tail wheel, furrow wheel and hitch points to balance the side-thrust between those two inclined wheels. As a first trial for a standard disk plow, the hitch should be adjusted along a line from the tractor centre of pull to the plow centre of resistance, a point a little below the soil surface and at the average of the centres of the disks. For a vertical disk plow, having a wide width of cut, it is quite common to hitch far to the right of the plow centre of resistance, so that the tractor pull may counteract the clockwise turning tendency, due to the side-thrust of the soil.

The width of cut may be adjusted on standard disk plows by changing the angle of the disks with respect to forward motion.

The depth of operation is limited by the wheels or by hydraulically controlled lift arms, if the disk plow is mounted.

Penetration to this depth depends on the angle from the vertical and weight per disk for the standard plow and on weight alone for the vertical plows. Some soil types require steeper angles for the standard plow to penetrate, other require a shallow angle.

Subsurface tooling adjustments

Implements designed to till beneath the surface have pointed and balanced tooling. Weight should not be resorted as a mean of securing penetration. The rake angle of the tool is increased to secure greater penetration (figure 5). The implement must be adjusted so that when the tooling falls onto the soil surface, an appreciable angle exists.

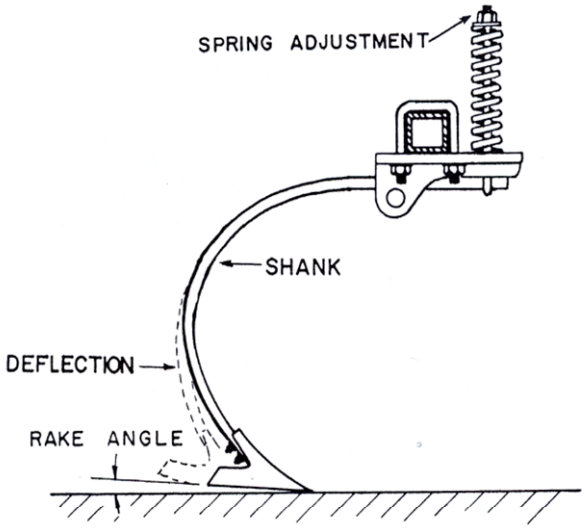

Figure 5. Subsurface tiller construction

Deflection of the shanks due to soil force causes the rake angle to increase. Excess deflection causes increased draft and unnecessarily deep grooves in the seedbed bottom. Springs absorb shock and permit the tooling to deflect over solid obstructions. The spring force should be adjusted to a level high enough that tool deflection is minimal in normal operations.

In figure 6 is presented least cost plow size for a single unit operation. From this figure, several conclusions may be drawn..

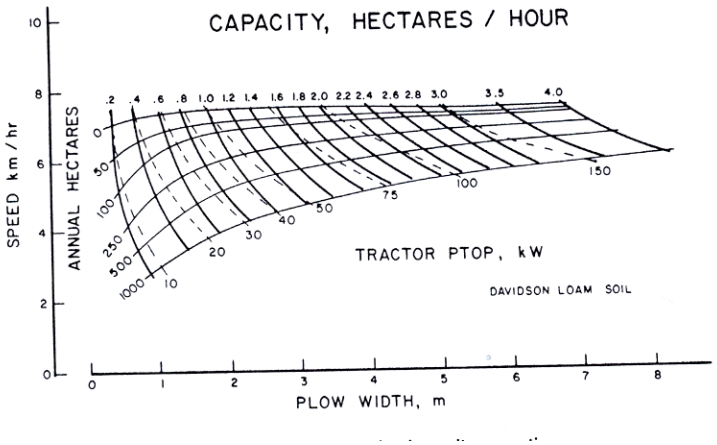

Figure 6. Least cost plow size

RESULTS AND DISCUSIONS

If the conditions assumed are typical and the plow draft-speed relationship is correct, plow speed should never be much above 7,5 km/h, and these speeds are profitable only for small areas. The increase in draft at higher speeds causes the power required and the accompanying fuel costs to rise rapidly. Instead, greater economy is obtained by purchasing larger plows with accompanying larger tractors and keeping the forward speed at a lower level.

CONCLUSIONS

From the experiments made with different tillage machines, different conclusions can be drawn. One of them is that larger equipment operating at slower speeds is indicated as being more economical as the total area of plowing increases. This conclusion is rationalized by the fact that fixed costs per unit of surface decreases as the use increases, thus it becomes more economical to operate with larger equipments.

Speeds are slower for the same required capacity and the economy improves even though the larger equipment has a greater purchase price

BIBLIOGRAPHY

1.HUNT D., 1995 - Farm power and machinery management, Iowa State University, USA
2.DUMITRU, M. , 2005 - Mecanizarea agriculturii, Ed. Alma mater, Sibiu