

Development of Agricultural Mechanics during the Past 50 Years

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Agricultural mechanics is a subdivision of the science on functional relationships of agricultural technological processes and machines. Particular knowledge provides a possibility to solve mechanisation issues of the agricultural production in a more motivated, economical and faster way. The development of agricultural mechanics during the past 50 years is connected with the problems and tasks of extension and perfection of mechanised agricultural production. It is developing in seven main directions:

- soil tillage mechanics (terra mechanics) and machines;
- mechanics of sugar beet diggers;
- mechanics of cutting devices for the beet tops;
- mechanics of sugar beet cleaning devices;
- mechanics of broad-grip machines and aggregates;
- mechanics of hydraulic drive and manipulators;
- mechanics of broad-grip fertiliser and chemical (pesticide) sprayers.

Approaches have been formulated and motivated concerning the course of soil tillage technological processes and energy requirement. In contrast to the previous views, a hypothesis was advanced and proved by A. Vilde that the draft resistance of the operating parts of the machines and the respective soil tillage energy requirement depend on the impact of dual forces upon them: the forces determined by the mechanical properties of soil (the mechanical strength (hardness) of soil which causes resistance to the penetration of the operating parts into the soil as well as resistance to its deformation), and the forces depending on the physical properties of soil (the forces of weight and inertia caused by the transferred mass of soil as well as resistance to friction and adhesion). Guided by this conclusion, relationships of the strength of materials and theoretical mechanics are applied for analytical determination of the forces acting upon the operating parts of machines and their elements. The obtained analytical relationships are used for the determination of optimal parameters of the operating parts of machines and the draft resistance in connection with the technological properties of soil and mode of working. On the basis of theoretical research a series of soil tillage machines and some devices were created for which 10 certificates of invention were granted. A computerised tribometric stand was developed in order to study the resistance of soil sliding along the surfaces of the operating parts.

Mechanics of sugar beet diggers, developed by A. Vilde, is a subdivision of terra mechanics. It is an explicit theory on functioning and energetics of one-share and two-share diggers. For the beet harvesters A. Vilde has designed a top cutting apparatus with adjustable correction of the cutting height that improves the quality of its work. A. Vilde has developed the mechanics of sugar beet digging, transportation and cleaning devices for the work in stony soils that increase their working safety on the conditions of Latvia.

A. Vilde, U. Pinnis, A. Cēsnieks, U. Bērziņš have established the main principles for efficient introduction and use of big high-power tractors, and have designed broad-grip high-speed soil tillage and sowing machines and aggregates for the work on uneven rugged terrain fields. The mounted machines and multi-sectional wide aggregates during the operation of which it is possible to transfer their extra weight (in order to perform technological operations) to a tractor using the automatic control system of the tractor hydraulic hitch-up device, hydraulic loaders or other similar means are the best machines on the conditions of Latvia. Therefore original designs and the modes of functioning of machines, couplings and aggregates have been created for which their authors have 12 certificates of invention.

A series of patented devices and schemes of hydraulic drives for loaders and manipulators were created in the Research Laboratory of Mechanics of Agricultural Machines for which 11 certificates of invention were granted (U. Dzintars, A. Mežs, V. Veidemanis, E. Kronbergs, V. Kolmakovs). Designs of a broad-grip fertiliser and pesticide sprayers were worked out (E. Kronbergs, V. Kolmakovs, I. Plūme et al.). Original

designs were created for their hooking on bars and manipulation for which 8 certificates of invention were granted. Under the guidance of A. Mežs and Z. Radziņš a machine for forestry (4 certificates of invention) was improved in cooperation with the Research Institute of Forestry. In the 1960s a lot of efforts was devoted to the analysis and synthesis of plane fore-link mechanisms (O. Ozols, V. Galvanovskis) and investigations of the dynamics of a jib in the lifting and lowering processes of loaders (V. Pūce).

Summing up, the investigations in agricultural mechanics and its achievements bear evidence of the development of agricultural mechanics during the past 50 years and its great importance for agricultural production.

Key words: agricultural mechanics, terra mechanics, hydraulic drive, optimisation of parameters.