

IMPACT OF CLIMATE FACTORS ON GRAIN YIELD OF SPRING BARLEY IN LATVIA

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Climate is very important determinant of agricultural productivity of spring barley sowings in Latvia. There is the possibility to use different soil tillage and sowing technologies for cereals production in Latvia's farms. Spring barley field almost are high cultivated, with drainage and sandy-loamy soils.

The impact of climate variability affect grain crop yield. Air and soil temperature, as well as the precipitation are the famous factors that impact spring cereals. Sowing time was directly influenced by soil condition. The difference of sowing time was some times one to two decades of month and that impact the management. Extreme events as the drought during month after sowing or spring froze in 1 - 2 leaf stage of spring barley influence the growing. The quality of grain yield and the income was impacted from rainfall in harvesting phase.

Agrotechnology. Investigations in production conditions are carried out in Research and Study Farm of LUA "Vecauce" in sod-podzolic loamy soils (60 % of arable land in Latvia) that are well cultivated and contains medium up to high content of potassium and phosphorus in autumn 1998 and 1999. Two-factor researches are established, where factor A – soil tillage and B – sowing technology.

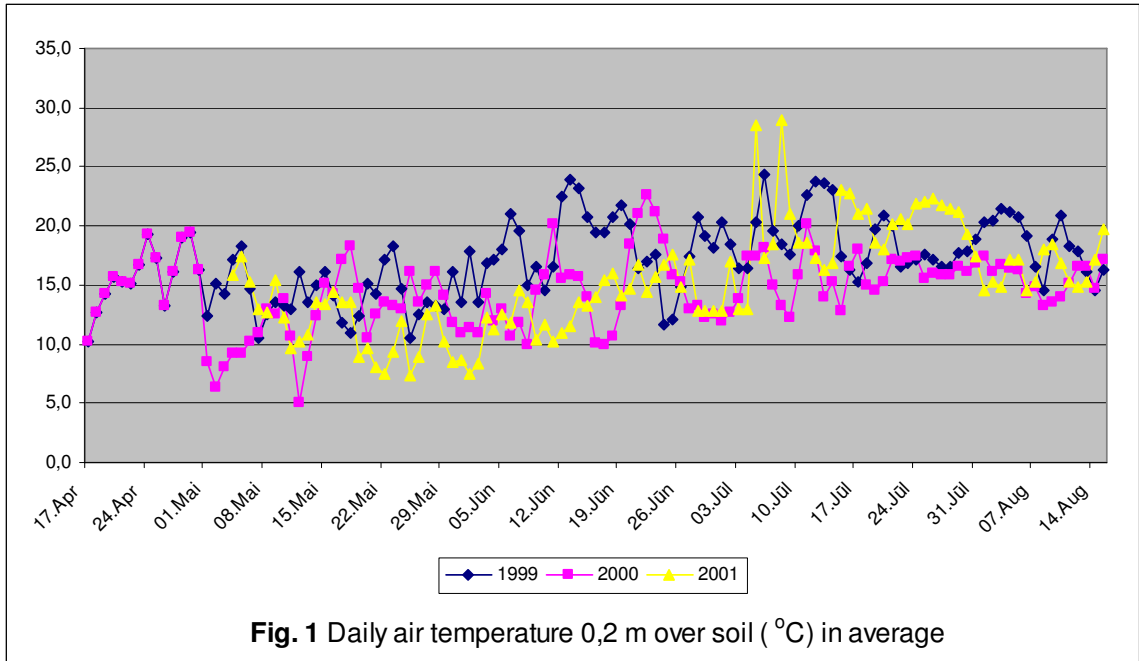
Factor A – soil tillage versions includes 4 gradations: A₁ – fall ploughing; A₂ – not ploughed stubble field; A₃ – spring ploughing with soil pacomat; A₄ - spring ploughing without soil pacomat.

Factor B – sowing technology includes 2 gradations – different sowing and mineral fertiliser distribution technologies:

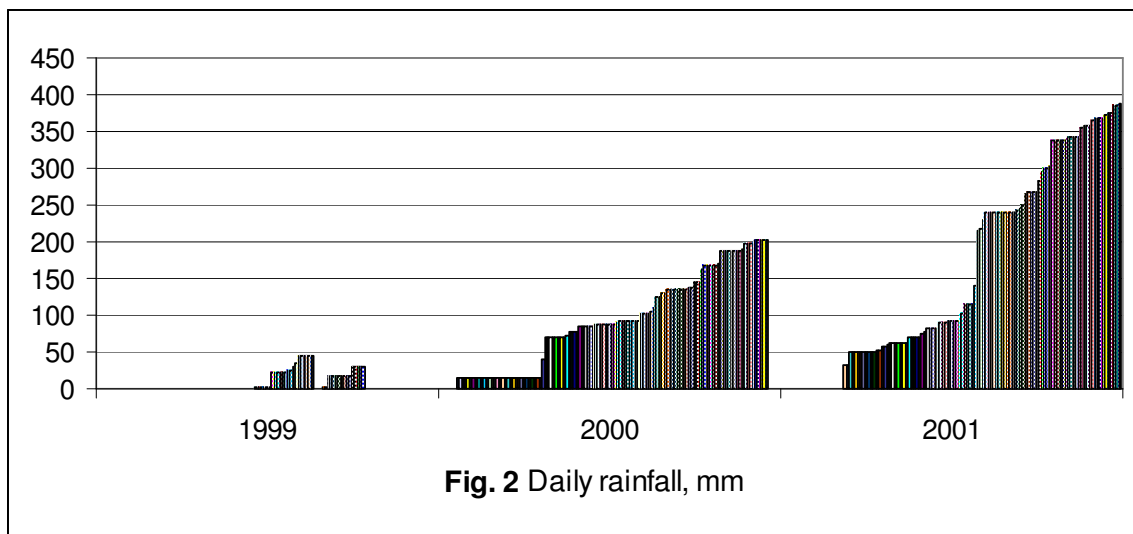
- sowing with the anchor type seeder *Amazone D8 – 45 Super*, and cultivating soil with the rototiller KG – 452 included in the combined unit, and mineral fertilisation before ploughing;
- sowing with the complex disc seeder *Rapid 300 C*, and locally turning in all mineral fertiliser doses together with sowing.

Spring barley variety 'Klinta' – 1st generation certified seed in 1999, and basic seed in 2000. Previous crop was spring barley. Used plough *Overum – 6DVL*, soil pacomat *Pakomat D-205-335 CM*. Sowing is accomplished in 12th of April 1999, and in April 17, 2000, sowing 350 germinable seeds per m². Mineral fertilisers were used at the rate of pure substance N:P:K= 70:70:98 kg per ha. The high-capacity pneumatic fertiliser diffuser *Terra Gator* dispersed fertilisers before sowing in versions where local fertiliser turning in together with sowing was not applied. The only difference method was hold maximally in the whole research of production. Spring barley fields were sprayed with the herbicide *Lintur – 120 g ha⁻¹* in all versions of sowing and soil tillage. Fungicide *Tango Super 1,25 l ha⁻¹* was used in all versions of sowing and soil tillage to control diseases of spring barley at the 37th grain growth stage after Cadox.

Characteristics of meteorological conditions in Research and Study Farm of LUA “Vecauce”. The optimal soil humidity for spring barley sowing started in 2nd decade of April in 1999 and 2000, but only in 1st decade of May in 2001. Unlike the season of 1999, a day before spring barley sowing in year 2000 precipitation was ~ 40 mm.



The end of April and beginning of May was characterised by the cold weather, frequent and intensive frosts, when there was a temperature of -7°C in the topsoil in year 2000. Crop growth was prevented due to the frost damage and decreased air temperature in 2000. Warm weather started at the end of the 3rd decade of May.



The reserves of productive humidity in topsoil were within the optimal amount in May. Scarcity of humidity in dry conditions was in year 1999, when its influence to the plants appeared in the end of May – beginning of June. Plants growth was in high speed due to the hot, dry weather in July, the grain dough development started in the middle of

July in 1999, and reached ripening in the 3rd decade. Dilatory growth of spring barley due to the algid spring and frost damages was in season 2000.

The summer of 2001 was characterized with sufficiency of the precipitation during barley vegetation and with deficiency of sunny days in harvesting phase that increased grain yield and its quality. The quality of grain yield and the income was impacted from rainfall in harvesting phase.

Observations and data processing. Sowing depth was determined for 50 plants in the 1st- 2nd spring barley leaf stage in every treatment version, measuring distance from the root to photosynthesis function zone – green plant. The number of seedlings was determined in 20 places in every version with 0,1 m² frame. Soil compaction in different soil layers was determined with the Revjakin set in 20 places in every version. The average soil sample in different soil layers was taken in 1-3 grain leaf stage from 20 places for every variant to determine content of nitrate, ammonium, potassium and phosphorus in certified laboratory.

Table 1 Spring barley productivity, t ha⁻¹, depending on different soil tillage and sowing technologies in RSF “Vecauce” during 1999-2001

Soil tillage and sowing technology		1999	2000	2001
Rototilling + sowing (anchor ploughshare) <i>Amazona</i>	Sowing without the soil reversing (direct sowing)	4,47	9,11	5,63
	Ploughing in spring without soil pacomat	4,14	9,08	5,96
	Ploughing in spring with soil pacomat	4,56	7,24	6,17
	Ploughing in autumn	2,90	7,12	6,37
Sowing with disk seeder <i>Rapid</i>	Sowing without the soil reversing (direct sowing)	4,33	7,87	3,91
	Ploughing in spring without soil pacomat	3,61	9,90	5,37
	Ploughing in spring with soil pacomat	3,08	7,62	6,12
	Ploughing in autumn	2,76	6,28	4,95
□ 0.05		0,48	0,71	0,53
Coefficient of variation, %		20,4	13,7	18,2

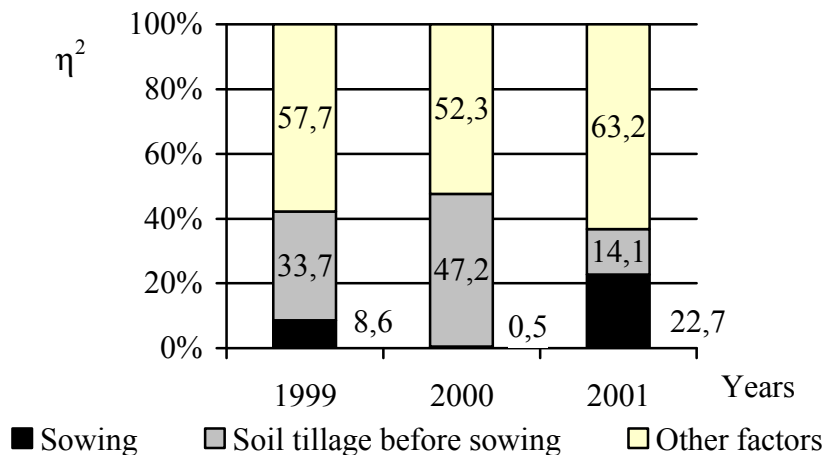


Fig. 3. The density of influence of soil tillage and sowing for grain yield of spring barley in RSF „Vecauce” during 1999-2001

Spring barley yield t ha⁻¹ was determined in five places in every variant with the analysis of sample sheaf, and recasting yield per ha. The method of randomisation was

used to choose the place to take a sample. Two-factor dispersion analysis was applied in data processing, and significance of residuals was evaluated by the Fisher criteria.

It is ascertained that grain yield was significantly low in autumn ploughing variant in comparison with spring soil tillage variants during all trials in total. Using of the soil pacomat for seedbed preparation in cold spring with frost can significantly to increase grain yield of spring barley. The sowing without soil reversing with combine aggregate Amazone or disk seeder Rapid gave a similar level of grain yield with spring ploughing variants. Although, there was significant increase of yield even in dry spring. The choice of sowing technologies have more less influence on grain yield in comparison with soil tillage, meteorological conditions, the field and other factors.

Preliminary results

To supplement agronomical trial results by meteorological data in comparison with software demands was problematic, because I have now only daily average temperature and daily rainfall during growing period for my experiment field. The Cropsyst and others modeling tools require min and max temperature.

I presented AGRIDEMA tools possibilities during the seminar in Faculty of Informatics of Latvia University of Agriculture (LUA) in 15 December 2005.

The modeling tools possibilities will presented in International conference “Multifunctional agriculture at the outset of XXI CENTURY: Challenges and risks” in Jelgava, 22.-24.03.2007.

One student of LUA Faculty of Informatics elected the research theme “IT for the forecast of crop yield in comparison with meteorological conditions” for Bachelor of Computer science Paper.