

Innovations in Landscape Research



Manfred Frühauf · Georg Guggenberger ·  
Tobias Meinel · Insa Theesfeld ·  
Sebastian Lentz *Editors*

# KULUNDA: Climate Smart Agriculture

South Siberian Agro-steppe  
as Pioneering Region  
for Sustainable Land Use

 Springer

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Region for Sustainable Land Use

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ISSN 2524-5155

ISSN 2524-5163 (electronic)

Innovations in Landscape Research

ISBN 978-3-030-15926-9

ISBN 978-3-030-15927-6 (eBook)

<https://doi.org/10.1007/978-3-030-15927-6>

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The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

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## Chapter 37

# Field Days for Technology Transfer and Knowledge Exchange of Dealers and Farmers



V. I. Belyaev, M. M. Silantyeva, T. Meinel, L.-C. Grunwald, D. V. Belyaev, N. A. Kozhanov and L. V. Sokolova

**Abstract** For the regional implementation of new land-use technologies, the practical cooperation of science, enterprises of the agricultural sector, machine builders and dealers are crucial. The knowledge exchange of these actors makes a great contribution to the introduction of new technology, their adaptation to regionally specific requirements and further development of innovative practices. 'Field days' have proven to be a very effective model in bringing engineers, dealers and farmers together to dispute over usage and perfection of new machines.

**Keywords** Field day · Technology transfer · Knowledge exchange

### 37.1 Teamwork

In October 2016, Russian and German partners summed up the five-year work on the international research project 'Kulunda' (2011–2016). The goal of the project was the development and implementation of innovative technologies for steppe land use,

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© Springer Nature Switzerland AG 2020

M. Frühauf et al. (eds.), *KULUNDA: Climate Smart Agriculture*, Innovations in Landscape Research, [https://doi.org/10.1007/978-3-030-15927-6\\_37](https://doi.org/10.1007/978-3-030-15927-6_37)

**Fig. 37.1** Discussion during a Field day



designed to prevent further development of erosion processes, to ensure soil fertility and efficient use of land resources in the dry territories of the Altai region (Illiger et al. 2014). For those five years, German scientists and their Russian colleagues (Altai State University, Altai State Agrarian University, Institute of Water and Environmental Problems of the SB RAS) established a unique monitoring network in the Altai region. Its task was and still is to observe the main climatic and soil parameters, which have a significant impact on crop yield under the complex diverse conditions of this region (Belyaev 2013; Ponkina et al. 2014).

An important feature of the Kulunda project was the work on the implementation of its research findings, especially through practitioners, including farmers and farm machinery dealers. In the Altai region, the Department of Agriculture, the Department of Economic Development, the Department of Natural Resources and Environmental Protection, the Office for International and Interregional Relations, the Committee for Agrarian Policy and Nature Management of the Altai Regional Legislative Assembly supported this strategy.

## 37.2 Materials and Methods

For the transfer of knowledge to farmers and its implementation, the Days of Crop Production (Field Days) were held by the farm OOO KH Partner every year in early August. The number of participants was up to 450–550 people each year, including heads of the Altai region, from the Altai Regional Legislative Assembly, the Department of Agriculture and the participating regions, heads and chief specialists from other farms, scientists, researchers from the Kulunda project, dealers of machinery manufacturers and others (Figs. 37.1, 37.2 and 37.3).

The events included a plenary part where project participants reported the results of research over the past years, and the practical part with a visit to the base experimen-

**Fig. 37.2** Participants in a Field day



**Fig. 37.3** Scientist explaining test arrangements during a Field day



tal sites and the demonstration of innovative machines for prospective agricultural technologies. This form of knowledge transfer has aroused a high interest among farmers, has excellent visibility and application value.

Interim results and the progress of the 'Kulunda' project were covered for the federal, regional and district media: VGTRK Altai, Katun-24, TV Mikhailovskoye +, Rossiyskaya Gazeta, Altai Pravda and Silver Rain were represented at regional Agronomic Conferences on agriculture in other districts of the Altai region, in Kazakhstan, on the Days of Plant Growing of the Amazon Company in Germany.

Participants of the 'Kulunda' project took part in seminars organized by the Institute for Advanced Training of Agroindustrial Complex Workers. Now, special educational programmes are being developed in Altai State University and Altai State Agricultural University with an emphasis on resource-saving technologies in agriculture. The project team together with practitioners published the collective vol-

**Fig. 37.4** Machinery exhibition during a Field day



**Fig. 37.5** Students at gaging station



ume 'Economic, ecological, technological factors and results of activity, agricultural enterprises in conditions of the Kulunda Steppe'.

### 37.3 Stationary Base Sites and Experiments

Constant measuring and test sites were created on three farms: OOO KH 'Partner', Mikhailovsky district, ZAO PP 'Timiryazevskiy', Mamontovsky district, and FGUP PZ 'Komsomolskoye', Pavlovsky district of Altai region. Scientists and practitioners conducted complex observations and exercise of innovative technologies for crop cultivation in crop rotations (148 variants of combinations of technological factors at 356 plots, including 'strip-till' and 'no-till' technologies), using modern and excellent equipment (Figs. 37.4 and 37.5).

The company 'Amazone' technical provided equipment for new land-use technologies, namely two experimental drills for 'no-till' technology (Belyaev and Meinel 2013; Belyaev et al. 2013, 2014; Belyaev 2015), which allow to change seeding characteristics (seeding rate, fertilizer application rate, depth of seeding, row spacing, type of working elements), and also a 'strip-till machine with adjustable parameters. The EDX precision drill was purchased by the farm OOO KH 'Partner'.

The Kulunda project installed the first lysimetric station in the dry-steppe ecosystem in Russia. It measures precipitation and evaporation in the soil in real-time mode, the accumulation and migration of nutrients in the soil, as well as other important soil parameters at various depths. Long-term analysis of these data, which is performed by the local University partners, will reveal the dependence of crop yields on a variety of climatic and soil parameters. In combination with experimental data on soil cultivation technologies in test fields, those results will allow for developing recommendations for farm enterprises to reclaim saving technologies that include technical re-equipment, soil treatment, fertilization, plant protection, etc. The uniqueness of the lysimetric station is its ability to measure these parameters simultaneously in soils used for arable land and in soils of the natural steppe. This provides the basis for research and helps making the right decisions in the selection of long-term strategies for the development and more rational use of the resources of the Kulunda steppe (Belyaev et al. 2016).

For the same purposes, three automatic meteorological stations and four stations for measuring soil moisture in the forest-steppe and steppe zones of the Altai region have been installed. They allow for the retrieval of more detailed data, which, combined with the results of space probing, will make it possible to predict the crop yields.

### 37.4 Main Scientific Results

The impact of climate on crop yield is highly significant (Belyaev and Sokolova 2015, 2016). Preliminary results on climate change in the Altai region were obtained. In the distribution of the surface air temperature in the flat territory of the Altai region (Barnaul), a statistically significant positive trend was revealed, more intense than the average for Russia (0.9 °C for 1901–2000). In the distribution of precipitation, a secular cycle (1862–1976) with the duration of 115 years was identified. Since 1977, the ascending branch of a new century cycle began, the maximum of which is likely in 2038 with the subsequent reduction of precipitation. Currently, after a wet period of 1986–2002, the cycle of lowered moistening develops. It can accelerate desertification processes in the Altai region and change the ratio of areas occupied by one or another type of vegetation, because the rate of air temperature growth outstrips the rate of increase in precipitation.

In the framework of the study of soil degradation, an electronic data bank has been established that clarifies and extends the technical capabilities of soil monitoring in the Altai region (Grunwald et al. 2015).



**Fig. 37.6** Sprayer 'AmaSpot' 'Amazone' for weed control. *Source* Meinel (2014)

On the basis of KH Partner LLC (Altai Territory, Mikhailovsky District, Polumyuki Village), unique experiments were conducted to assess the condition of degraded pastures in the dry steppe zone of Kulunda. The experimental site has been laid for testing 28 varieties and plant species that can be used for pasture restoration. As a result of observations 2011–2016, four key species of the legume family were identified, which were sown on experimental sites to improve haylands and degraded pastures. The restoration of the true steppe has not only scientific, but also great practical significance. Socially and economically, this will mean a gradual transformation of the steppe from the zone of risky farming into a zone of harmonious combination of stable cattle breeding and a sparing natural farming environment. The solution of the problem of ecological transformation of the landscape and land fund will favourably affect the water regime of the steppe, will contribute to the conservation of biological diversity, and will significantly weaken the anthropogenic factor in desertification of the steppe zone of the Altai region.

In addition, experiments were undertaken to restore natural haylands and pastures using a combined soil cultivator Catros-6001-2 Green, equipped with a device for sowing grass seeds. Seeds were obtained from the collection site in local conditions.

This combined machine has been manufactured to introduce the technology liquid fertilizers, including microelements, in fields with crops. Field experiments have been established, and significant results have been obtained on the effectiveness of the developed technology (the yield increment in individual fields was from 0.2 to 0.9 t/ha).

The technology of weed control using the 'AmaSpot' system on the sprayer was successfully tested and implemented in the OOO KH 'Partner' on fallow fields, which makes it possible to significantly reduce the use of plant protection products due to selective exposure to weeds (up to 70–80%) and to reduce chemical load on the soil (Fig. 37.6).

On the test fields, studies were carried out comparing three different types of farming technologies and four levels of intensity of autumn soil cultivation in crop rotations. As a result, practical recommendations for cultivating crops with the use of new generation techniques, perfect agricultural practices for tillage, methods for applying fertilizers and plant protection systems in the dry and real steppe, as well as forest-steppes of the Altai region, have been developed.

### 37.5 Conclusion

Preliminary analysis of experiments, as well as previously conducted studies, confirms a number of advantages of preserving technologies from the energy, agro-technical, ecological and economic point of view. The introduction of the research results will significantly reduce the operational costs of grain production and increase the productivity of arable land. This includes an increase of productivity up to 35–45%, achieving significant reduction of fuel consumption of the machinery (1.5–2.6 times), reducing the negative impact of machinery on soil (reducing the number of passages over the same lot 3–5 times), saving seed material by 15–20%, increasing the average yield of cereals to 2.0–2.5 t/ha.

Thus, the practical cooperation of science, enterprises of the agricultural sector, machine builders and dealers made a great contribution to the development of innovative practice in perfection and introduction of perspective agricultural technologies and machine complexes for cultivating agricultural crops under dry climate conditions. Field days for technology transfer and perceptions of dealers and farmers play an important role in this process.

This work, performed on the base sites of the 'Kulunda' project, is very much significant in terms of volume and obtained results and only large research institutes are able to do it. Therefore, in the long run, it seems adequate, to install a regional research centre for the study of climate, soil conservation/degradation and approbation of adaptive farming technologies. It should be based on the test fields, which are already laid. It can serve as a basis for disseminating information on the best land use practices and create a stable scientific and practical advisory platform in the implementation of the programme 'Sustainable Development of Rural Territories of the Altai region' until 2025.

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