



Theme 1

Status and trends of global soil nutrient budget



Diverse crop rotations sustain soil management and food security in Kazakhstan

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INTRODUCTION

Currently, agriculture faces various challenges. The stable food provision for humans is affected by negative factors. The major one is the exponential growth of the world's human population (1). Right now, the full supply of agricultural commodities is highly dependent on geopolitics (2). Unfortunately, a soil management and soil fertility conservation take a back seat due to the intensive soil cultivation for the agricultural production. More and more countries started to pay attention to the safe crop cultivation. It is necessary to elaborate the policy not how to feed over 9 billion people in 2050, but how to do it in a balanced way: supplying food without compromising natural resources. One way is to increase yields through the intensification of cropping systems and the expansion of sowing areas. The selection of a suitable cropping system cannot be determined in a single cycle (sowing-harvesting) for the advancement of crop diversification. Therefore, crop rotation is an important component of an integrated approach to sustainable agriculture coupled with resource conservation (3). Crop rotations and its proper management can provide a multilateral effect (4; 5). It is known that the cultivation of individual crops in a crop rotation can improve the sustainability of the cropping system (6).

Kazakhstan also promotes a policy of diversification of crop production with a tendency towards a balance between the consumer of agricultural products and the conservation of the country's natural resources, thus, contributing to the sustainable development of agriculture in the world. Diversification of crop production in Kazakhstan is necessary not only to create a biodiversity landscape and obtain the various crops, but also to grow crops in the climate change conditions. However, a lack of research has been done on selecting the suitable crop rotations and selection of crops in the arid steppes of the northern Kazakhstan under changes in climate.



METHODOLOGY

Place and soil and climate characteristics.

The study was done in the field trial of the Laboratory of Crop Rotations, the Barayev Research and Production Center of Grain Farming (N 51°38.369', E 071°01.259'). The soil is southern carbonated chernozem (black soil).

Scheme of study.

Different crops (fallow, oat, lentil, and mustard) have been studied as predecessors of wheat, which is a focal staple crop in the northern Kazakhstan. Four types of crop rotations have been tested, including "fallow-wheat-wheat-barley" (control), "oat-wheat-wheat-barley", "lentil-wheat-flax-barley", and "mustard-wheat-pea-wheat".

The experiments have been carried out for 3 years (2018-2020).

Photographs depict various predecessors on the field trials

Image by Akhmetova A.



RESULTS & CONCLUSION

In Kazakhstan, fallow has historically been used as the best predecessor for a spring wheat. However, recent studies are increasingly promoting avoiding fallow due to climatic conditions in the north of the country.

In all studied crop rotations, we found that oat, mustard, and lentil, as wheat predecessors, gave yields almost identical to the fallow predecessor. It was 21.4 centner/ha after fallow, 20.1 c/ha after oat, 18.8-18.9 c/ha after lentil and mustard, respectively. As a result, the oat appeared to be the second-best predecessor.

The most productive crop rotation turned out to be "oats-wheat-wheat-barley" with 21.3 centners per 1 ha of arable land. It is 4.5 centners more compared to the control. The productivity of the crop rotation "mustard-wheat-pea-wheat" is slightly less (16.6 c) compared to the control (16.8 c).

Thus, cultivating diverse crops in rotations allows producing more biomass and grain, thereby ensuring a stable supply of food and saving soil resources.

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