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Possibility to Introduce Covered Tillage Technology into Mongolia

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ABSTRACT

As a result of covering soil surface with straw, temparature reduced by 2 degrees during the planting season, moisture of soil increased by 5.5 mm and plantlet of wheat seeds incresed by 6.2 per cent respectively. Thehumus content reduced of 0.10 per cent less in uncovered version than in the covered version, where as the humus decline in the minelral version reduced from 0.06 to 0.14 percent less than other fertilized version, therefore we analyzed that decomposition of organic matter may stabilise due to the effects of straw covering and fertilizer.

Total number of micro-organisms in the covered tillage is 32.8 million more than in uncovered tillage, also nitrogen absorbing aerobic bacteria is 1.4 times higher, and anaerobe bacteria are 2.6 times higher.

Keywords: *brown soil, straw covering, soil humus, micro-organism*

INTRODUCTION

Mongolia has an extreme continental climate, and its' plant cover is loose, soil humus layer is thinner, has mainly light mechanically compounded soil, low precipitation in winter, dryness in spring. On the other hand, using a short rotation of grain fallow has created agro-ecological conditions such as vulnerable and a poorly-recovered environment.

Under this situation, crop technologies need to be adapted to mitigate these negative consequences of the climate.

Creating a large amount of plant covering will protect the soil from direct sunlight, and its consequences. The final result of our research work is focused on identifying the changes of soil moisture regime of the covered area furthermore, the positive and negative impacts on the soil, vegetation and soil micro-organisms.

The first preparation of covered technology is to create a covering by shredding and sprinkling straw under the grain production condition then to protect from animal footprints. For our country, due to rate of the unit yield is relatively low (on average 12 c / ha), the special attention should be paid to the increase of plant residue remaining on the surface after harvest.. We are creating the cover by sprinkling the straw with cutting and without cutting also with other remains based on our own possibilities. First of all, one of the important requirements for this technology is to be able to cut the straw on the back of the combine and to have a wide even spread (5-6 m)

According to our dry land, creating a cover on the field:

1. The wind erosion will be completed in farmland area.
2. Reduction of soil heating will reduce, the soil moisture loss by 10-15% and the inefficient loss of fertility will be reduced by at least 15%.
3. The soil moisture content will increase and as the result organic decomposition will reduce and at last the balance of fertility will stabilize and multiply.
4. The ecological balance will be ensured and the crop yield per hectare will stabilize and eventually the economic capacity of the crop will be improved.

No-tillage technology or worlds' largest countries that engaging covered farming is completely refused to breaking the soil and started following the no fallow system.

For instance, Canada where the precipitation falls similar in Mongolia (200-400 mm) has removed already into covered farming system.

RESEARCH METHODOLOGY

Place of Study and Duration

Field research was conducted in 2013-2015 at experimental site of the Institute of Plant and Agricultural Sciences in Darkhan –Uul province KhongorSoum.

Wheat Farming

On the 15th of May, "Darkhan-34" varieties of wheat were planted by "John deer" seeder. The seeds sprinkled on the 3 million /ha land, in a depth of 4 cm and 19 cm between the rows and the fertilizer put in a depth of 6 cm.

METHODS FOR RESEARCH AND ANALYSIS

- Soil warming measured by soil temperature meter / thermometer /
- Soil moisture content is measured in a depth of 0 - 100 cm, by weight method of 10 cm frequency.
- The density of the soil surface (0-10 cm) was determined.
- Total bacteria, nitrogen fixing, actinomycetes and fungus were installed in the selective environment by dilution method of "Kox", then were grown in incubator 3-10 counted in colonies.

EXPERIMENT OF FERTILIZED VERSIONS:

- Monitoring
- N20P10
- Riskobacteria 6 kg / ha
- VozaGreen micro bio fertilizer, 2.5 l / ha

RESEARCH RESULT

During the experiment, the 3t/ha straw on the surface of land which were created unnaturally should be protected from the solar overheating. So that, it is necessary to reduce the evaporation of soil moisture during the overheating and spring season and to increase the moisture supply at the early stages of crop development. They are approved by research result and need to be improved in future.

For example, In a result of the two years study, before planting 15th of May, The soil warming tested both in covered and uncovered tillage. The temperature was 13.3 degrees in the depth of 0-5 cm and 7.55 degrees in the depth of 5-10 cm on the uncovered tillage which were 2°C higher in a depth of 0-5 cm and 1,5°C warmer in the depth of 5-10 cm compared to the covered tillage.. The difference in soil heatdetected more in 2015 when the temperature fluctuation of days and nights was higher. So the differences are 9°C warmer in the depth of 0-5 cm, and 1° C warmer in a depth of 5-10 cm. .

According to these findings, creating 3 tons of straw covering can be able to reduce the surface of soil warming by 2 degrees during planting (15th of May).

Creating a cover and building fence to protect from animals is not only increases the preservation of the remaining stalks on the surface but also increases the snow formation in winter and keeps it long enough and eventually reduces the moisture loss (Table1)

Table1. *Study result of the soil moisture, soil heat, field germination of the covered and uncovered tillage (2014-2015)*

№	Version	Soil heat , C^0		Soil moisture, мм		Wheat field germination, %		
		0-5 см	5-10 cm	0-30 cm	0-50 cm	2014	2015	Average
1	Uncovered	13.3	8.05	46.8	70.9	50.6	52.9	51.8
2	Covered	11.3	6.55	47.5	76.5	60.4	55.5	58.0

The spring planting is most important indicator in our country's agriculture technology. The basic requirement for the appropriate planting time is to plant and germinate the seeds in a moist soil. Creating a cover and solving this issue in an appropriate level are shown by observation and quantitative data of our survey.

During the rotation, when the soil moisture determined before 3rd and 4th round planting, in the0-30cm depth of soil moisture is 46.8 mm in the uncovered tillage which is 0.7 mm lower than in the covered tillage one. Similarly in the depth of 0-50 cm moisture is 70.9 mm or 5.6 mm lower than in the covered tillage. This pattern is repeated in any year of the research

In other words, when soil unfreezes in spring, the moisture transfers to the surface of land and the purpose of the cultivation technology is to hold this moisture in the soil surface. This moisture will help to maintain the normal condition of seed germination.

For planting and starting a harvest, the most crucial thing is starting point and the first stage of harvesting is to create a condition of normal

seed germination. The germination of covered field was more than 9.8 percent in 2014 and 2.6 percent in 2015 respectively compared to the uncovered field.

This field germination is explained by forming the proper ratio of moisture and heat and also germinating seeds equally. (Table1).

One of the key indicator of fertility is the humus content of the soil . Organic soil is accumulated over a long period of time due to the presence of residues and microorganisms below and below the plant. Organic residues are a source of nutrient formation and nutrient enhancement, and a key role in improving the physical properties of soil and improving soil fertility.

In our country with a dry climate, residues of plants and other organic substances are easily decomposed, so the soil is slowly accumulating in organic matter.

According to the results of the analysis, it shows that experimental soil contains 1.08% humus at a depth of 0-20 cm, The table 2 indicates that is the poor soil in terms of fertility.

Table2. *Impact of brown soil fertilizer in covered and uncovered tillage (2014-2015) 0-20 cm*

№	Version of soil cultivation	Fertilized version	Before planting	After harvesting	Humus reduction , %
1	Covered	control /no fertilized/	1.08	0.96	0.12
2		$N_{20}P_{10}$		1.05	0.03
3		Riskobacteria 6 kg /ha		0.99	0.09
4		Vozagreen, 2,5 l/ha		0.91	0.17
5	Uncovered	control /no fertilized/		0.86	0.22

Before planting, the content of the humus was 1.08% both in covered and uncovered field, whereas after harvesting in uncovered field 0.10 per cent less than in the covered field. It is expected that the decomposition of organic matter is likely to be stable (Table 2).

However, based on the composting version, the decrease in humus was relatively low compared to other fertilizers, for example it reduced 0.06% from the release of the reizobacteria and 0.14% lower than the Vozagreen fertilizers respectively.

According to a recent study by Schroeder.D (1992), 80% of the organic matter of the soil is humus, 5% is (living organisms) and 15% is the root of the plant, 17% of is macrophages, 3% micro and mesofaun. About 80% of them is microorganisms.

All soil processes are involved microorganisms, which are sorted into bacteria, actinomycetes, fungus, and algae by their structure and biological characteristics, which multiply and die in the soil.

The number and type of soil microorganisms vary depending on soil moisture.

For example, the number of bacteria and fungi rises when the amount of moisture is higher but the percentage of actinomycin becomes high when amount of moisture is low.

The number of microorganisms and the number of nitrogen-absorbing bacteria are high in the covered tillage. It depends on the soil moisture and density.

For instance, table 3 shows that the number of micro-organism is 32.8 million /ha greater in the covered tillage than in the uncovered tillage one and the nitrogen absorption aerobic bacteria is 1.4 times higher and anaerob bacteria are 2.6 times higher respectively. As a result of the covering the number of nitrogen-absorbing beneficial bacteria has increased and soil structure and its fertility has improved

Table3. *The study result of the micro-organism in the covered and uncovered tillage, (2014-2015)*

№	Version	Total number of micro-organisms million/ha	The number of nitrogen absorbing bacteria, million/ha	
			aerobe	anaerobe
1	Uncovered	137.1	11.6	31.7
2	Covered	169.9	16.2	81.5

DISCUSSION

Doctor G. Gungaanyam (1998) did a research" Study the impact of covering on protecting the fallow area from wind erosion". According to the study, 3-6 t / ha of straw covering can increase the soil ability to withstand the wind by

2.7-7.9 times and increases the soil moisture content by 10.7-14 mm and eventually study found that the improvement of nutrient regime effects to the crop growth.

Dr. D..Myanganbayar (1996). His research titled "Possibility of protecting the soil from wind erosion by using straw covering". According to his study the cover reduces the soil erosion by 1.6 times, amount of the dust reduces by 13.7 t/ ha, temperature falls by 1.2 degree C and humus content in the soil increases by 0.25 per cent and eventually the nitrate nitrogen tend to be reduced. Reduction of erosion has increased the yield by 10.2% [10].

The straw is the source of feedstuffs, on average, N-0.5%, R2O5-0.25%, K2O-0.8%, and 35-40% carbon in the form of various organic compounds. On average, in the field of 20-30 h / h there are 10-15 kg nitrogen, 5-10 kg of phosphorus (R2O5), 18-24 kg of potassium (K2O), and other micro elements in the soil.

The straw cover accumulated 9.5 h / h organic matter in the depth of 0-20 cm of soil and increased the humus content by 5.7-9.1% [5].

CONCLUSION

- As a result of covering soil surface with straw, temparature reduced by 2 degrees during the planting season, moisture of soil increased by 5.5 mm and plantlet of wheat seeds incresed by 6.2 per cent respectively.
- The humus content reduced of 0.10 per cent less in uncovered version than covered version, wherease the humus decline in the minelral version reduced from 0.06 to 0.14 percent less than other fertilized version, therefore we analyzed that decomposition of organic matter may stabilise due to the effects of straw covering and fertilizer.
- The number of micro-organism is 32.8 million /ha greater in the covered tillage than in the uncovered tillage one and the nitrogen absorption aerobic bacteria is 1.4 times higher and anaerob bacteria are 2.6 times higher respectively.

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BRIEF INTRODUCTION OF THE AUTHOR

Baljinnyam Gunchin graduated from Mongolian University of Life Sciences in Darkhan-Uul province in 2008 and majored in agro chemistry. In 2010, I received master's degree in "The study of the effects of various types of soil fertility on the central agricultural region". Since 2008. I have worked as a researcher at the agricultural sector of Institute of Plant and Agricultural Sciences.

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