

The impacts of cultivating soil rapeseed (*Brassica napus* L.) as displacement plantation on soil fertility

Densmaa Sanjaa¹, Munkhjargal Ochirbat², Amarsanaa Bayar²

¹Doctoral candidate at Argo-ecology school of Mongolian University of Life Sciences, Ulaanbaatar Mongolia

² Professor, Doctor of Science (Sc.D) of Argo-ecology school at Mongolian University of Life Sciences

² Professor, Ph.D of Argo-ecology school at Mongolian University of Life Sciences

DOI: 10.29322/IJSRP.9.05.2019.p8986

<http://dx.doi.org/10.29322/IJSRP.9.05.2019.p8986>

Abstract- To determine the impacts of cultivating soil rapeseed (*Brassica napus* L.) as displacement plantation on soil fertility, the field experiments were conducted. Cultivation of the rapeseed (*Brassica napus* L.) is 9.3-10.3 center/ha which has been increased by 2.7-3.0 center/ha compared to the previous ones after cultivating fallow and leguminous. The study found out after replanting the rapeseed afterwards fallow and corn, the hummus was increased by 0.10-0.51% from other alternatives. Therefore planting rapeseed after planting fallow- wheat-rapeseed-corn as alternations increases the intensity of soil fiber growth by 10.0-37.07% or 0.005-0.02 mg / per day. Yield of rapeseed grain and its biometric indicators: the rapeseed is compounded more by composite fertilizers (N₂₆P₁₈) for 30 kg / ha compared to control version and other dose alternatives.

Index Terms- alternation, rapeseed, soil fertility, biological activation

I. INTRODUCTION

Mongolia mostly produces as a crop of wheat, especially wheat each year. Crop cultivation in the structure of the crop system is 90%, which does not meet the qualitative characteristics of the product. 90% of the structure system in agriculture is cultivation of seeds. Rapeseed yield and mechanical harvesting efficiency have been widely affected by agronomic practices, among which, plant density and row spacing have played a vital role in obtaining higher yields⁴. Thus, it is important to determine the appropriate plant density and row spacing that optimize both the seed yield and mechanical harvesting efficiency. Numerous researchers have investigated the effects of plant density and row spacing on agronomic traits and the yield of rapeseed. Research to determine the optimal plant density in combination with row spacing for the maximum mechanized production of rapeseed has been inconclusive because the results vary depending on the location, cultivar, soil type and local climate. For example, it is economically beneficial because of the high demand for domestic and foreign markets. In addition, the rape changes the composition of grain crops and it is important for the improvement of soil fertility and the stabilization of crop yields. It is useful to start domesticating the production of the rapeseed technology in Mongolia. There are following benefits for domesticating rapeseed in Mongolia. Which are :

- Increase the amount of agricultural field for plantation

- Reduce the proportion of fallow areas
- Creating 60-80% profitable an intensive type of displacement

II. METHODOLOGY

The experience of the field trip is carried out in 2014-2017 for four years in the field of learning center "Nars Center" in Bornuur soum in Tuv province, Mongolia according to field method.

A1st field experiment has 4 versions of 4 field rotations. The experiment plate width was 16,5 m and length was 40 m. Perimeter strip width was 1m, the separating strips between plates are 50 centimeters. Estimated area of the experiment plate is 10 square meters. The experiment was followed by the agro-technique which is used in Mongolia for the following sorts: Darkhan-74 soft wheat, Narlag bananas rice, Yubileiny rapeseed and Altaysky usatii peas.

A 2nd experiment was a monitoring and monitoring of compound fertilizer – has 5 versions which are unfertilized, N₂₆P₁₈ -20 kg/ha, N₂₆P₁₈ -30 kg/ha, N₂₆P₁₈ -40 kg/ha, N₂₆P₁₈ -50 kg/ha area active reactants. The experiment versions are placed in sequential order for 4 times of frequency. Estimated area of the experiment plate is 10 sq.m. The experiment was followed by the agro-technique which is used in Mongolia for the Yubileiny rapeseed sort of Ukraine. Perimeter strip width was 1m, the protecting strips between plates are 50 cm. Total size of the plate is 200 square meters.

III. STUDY RESULTS

The tabulate crop plants dominate in the crop rotation of our country. According to the researches done in Mongolia (by N. Altansukh, 1989, Ch. Damba, N. Nyamjav, 1978), the yield of wheat sort is mainly comprised of product stems per unit area, number of seeds of the single pappus and weight of 1000 seeds [2].

As stated in the results of the study (B.Ganbaatar, 2013), number of product stems is 219, number of seeds in the single pappus is 40.8 pieces, weight of 1000 seeds is 41.1 gr and seed yield was at 16.3 c/ha [2]. In contrast, our study shows that the height of the plant from Darkhan-74 sort wheat which was planted after fallow was 62-62.5 cm, products stems – 135 pieces, pappus seed number – 21.5 pieces, 1000 seed weight - 23.4-32.2 and the

seed yield was at 7.3-8.2 c/ha. The result is impacted by the lower precipitation rate and lack of moisture in the early phases of the research years.

Table 1
Harvest of tabulating crop plants, harvest structure indicators
(Tuv province, Bornuur 2014-2017)

Rotation	Turn	Plant height, cm	Product stem number, unit	Pappus seed number, unit	1000 seed weight, gr	Seed yield, ц/га
F-W-R-BRw	Wheat	62	136	23	32.2	7.3
	Bananas rice	68.9	176	42	13.8	6.5
F-W-P-R	Wheat	62.5	135	20	23.4	8.2
F-BNw-R-R	Bananas rice	67.3	199	43	13.8	8.8
F-R-W-W	Wheat	59.2	138	23	31.3	6.9
	Wheat	56.8	142	23	30.2	6.3

According to the study results, the highest seed yield is the wheat planted after the fallow which has yields of 7.3-8.2 c/ha. The rotation versions other than monitoring rotation have higher yields. The yield of bananas rice planted after the fallow is the highest which is at 8.8 c/ha and the ones planted after rapeseed are relatively low, showing yields of 6.5 c/ha. In addition, the yield of the wheat which was replanted after the rapeseed is 6.3-6.9 c/ha.

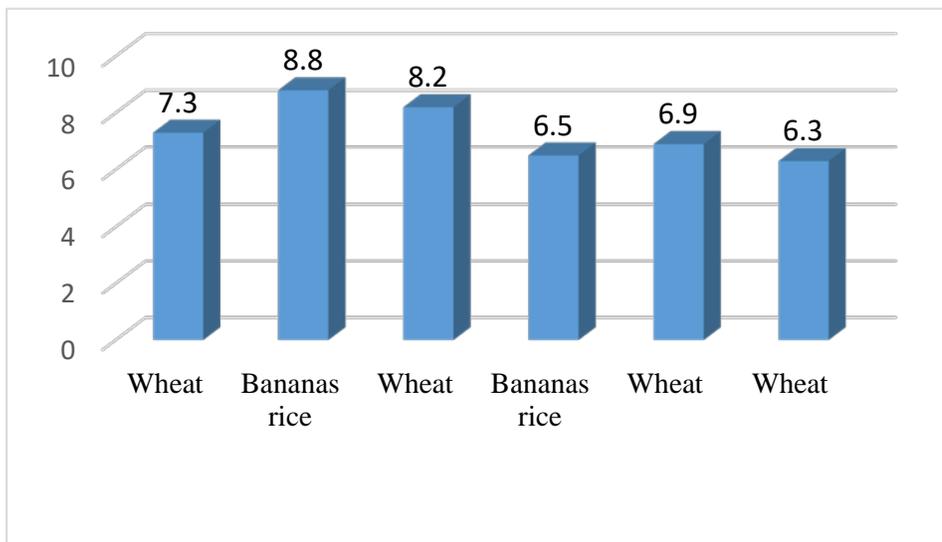


Diagram 1. Seed yields of the crops of rotations c/ha, (2014-2017)

Recently, rapeseeds are introduced to our country’s plant rotation and it accounts to around 20% of total farming lands. F.I.Safiillin (1990) determined that the product quality of the rapeseed depends on the number of fascicule of one plant, number of seeds in the fascicule and 1000 seeds weight. [8]

Table 2
The harvest of rapeseed, harvest structure indicators
(Tuv province, Bornuur, “Nart” center, 2014-2017)

Rotation	Turn	Plant height, cm	Number of product branch, unit	In one plant		Number of fascicle seeds, unit	1000 seeds weight, gr	Seed yield, c/ha
				Number of fascicle, unit	Seed number, unit			
F-W-R- BRw	rapeseed	80.5	2.6	54	658	11	3	7.6
F-W-P-R	rapeseed	84.8	3	61	926	15	3.5	10.3
F-BRw-R-R	rapeseed	73.3	2.3	53	666	11	2.8	6.4
	rapeseed	73.2	2.5	56	634	11	2.8	6
F-R-W-W	rapeseed	80.1	3.2	58	874	12	3.4	9.3

The study results show that the yield of rapeseed planted after peas brought the highest amount of harvest which is 10.3 c/ha and is higher than other versions. The study also revealed that when the rapeseed absorbed the nitrogen in great amount, the yield increases. Like other leguminous plants, peas absorb nitrogen from the air and accumulates it in the soil and that positively impacts the rapeseed planted afterwards. Whereas, rapeseed planted after the fallow has yields of 9.3 c/ha and it was impacted by the fact that there has been certain amount of moist reserve in the early periods of harvest around May and June. The lowest amount of yields came from rapeseed planted after wheat and replanted rapeseed.

The height of Yubileiny sort plant in the fallow-wheat-peas- rapeseed rotation is 84.8 cm, number of product stems is 3, number of fascicules in one plant is 61, number of seeds is 926 and seed yield is 10.3 c/ha. Compared to monitoring and other rotation options, its plant height is 4.7-11.6 cm taller, number of fascicules in one plant is higher by 3-8 pieces, seed number is greater by 292 pieces, number of seeds in the fascicule is higher by 3-4 and seed yield is greater by 1.0-4.3 c/ha.

According to the studies conducted in Russia for Altaisky usatii sort peas, the plant height is 71.5 cm, number of beans is 15-17, seed number is 45, 1000 seed wights is 176-251 gr and our study for the above sort showed that plant height is 49.1 cm, number of beans in one plant is 15, seed number is 69, seed weight is 230 gr and the average yield amount is 4.4 c/ha.

Table 3 exhibits that peas harvest has been declining year by year, but that slightly impacts to the next plant. The low moist supply in the earlier periods of harvest growth in the recent years impacted a lot. But the rapeseed harvest is being increased in the fallow-wheat-peas- rapeseed rotation as compared to other rotations and it confirms that leguminous plant is a good antecedent for a plant.

In 2014, 2015 which are earlier years of the study, the climate has been normal and Altaisky usatii sort peas yield was

5.8-6.6 c/ha. And in exceptionally dry years of 2016, 2017, the yield of peas seed fell sharply and reached to 3.6-1.6 c/ha.

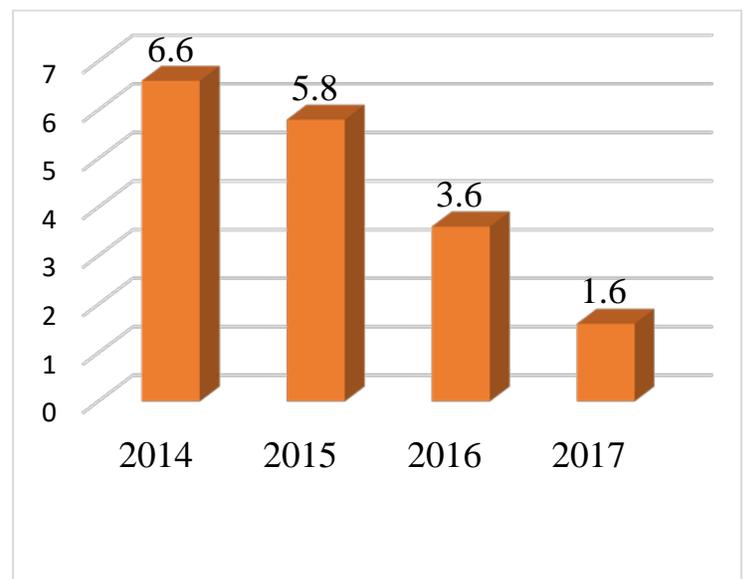


Table 2. Peas seed harvest, c/ha

The low moist supply in the study years has greatly affected the yield.

We determined the spread of rotation plants national system through using index method, calculating every 1 m² and 10 cm². In terms of total national statistics, the highest rapeseed is 2822.5 and lowest peas was 362.7 which is 7 times higher. The rapeseed roots were greater than wheat by 1525.8 and bananas rice by 2086.3. It shows that national system spread of rapeseed is relatively higher. The national spread of all the plants are spread most in the 0-30 cm of the soil. The national spread is being decreased in the soil depth. The fact that rapeseed turn spread is

higher than other turns reveals that rapeseed is the good antecedent of plants.

Table 3
National spread %

Rotation	Turn	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
F-W-R-BR	Fallow	-	-	-	-	-	-	-	-	-
	Wheat	13.2	20.2	18.7	17.2	15.2	10.1	2.9	1.3	1.2
	rapeseed	16.6	22.7	19.5	15.2	13.5	9.6	2.7	0.2	-
	Banana rice	31.6	22.2	16.9	12.1	7.9	6.3	2.3	0.5	0.0
F-W-P-R	Fallow	-	-	-	-	-	-	-	-	-
	Wheat	12.6	12.8	15.5	16.8	17.2	18.7	5.3	0.7	0.3
	Pea	24.1	25.8	20.6	11.0	10.9	3.4	2.9	1.3	0.0
	Rapeseed	18.0	23.0	20.0	13.2	11.0	9.2	4.6	0.9	0.1
F-BR-R-R	fallow	-	-	-	-	-	-	-	-	-
	Bananas rice	28.1	17.2	14.5	14.3	11.0	8.6	4.1	2.1	0.1
	Rapeseed	18.0	24.0	20.0	16.0	12.0	8.5	1.2	0.1	0.2
	Rapeseed	19.0	23.0	19.5	13.6	11.1	7.5	4.3	1.9	0.1
F-R-W-W	Fallow	-	-	-	-	-	-	-	-	-
	rapeseed	17.3	22.8	18.7	15.0	10.8	10.4	4.6	0.3	0.1
	Wheat	15.0	22.4	18.9	15.0	14.1	12.4	2.1	0.1	-
	Wheat	14.0	23.0	17.6	16.4	13.6	11.8	3.2	0.4	-

If we take the national spread of F-W-R-BR rotation plants by percentage, the national spread of rapeseed and wheat are highest in the 10-20 cm, and bananas rice is more concentrated in 0-20 cm.

The national spread of wheat is decreased by 1.5-19%, rapeseed is decreased by 3.2-22.5% and bananas rice is decreased by 9.4-31.1% to the soil depth respectively. For the national spread of F-W-P-R rotation plant by percentage, national spread of wheat is seen the most in 20-30 cm and, rapeseed and peas are at highest in the 10-20 cm. In contrast, F-BR-R-R rotation national spread percentage shows that the spread of bananas rice is highest in 0-20 cm and 1st and 2nd year rapeseed are spread the most in the 10-20 cm which is almost same for these two years.

If we take the F-R-W-W rotation national spread by percentage, the rapeseed national spread is shown the most in the 0-20 cm, 1st and 2nd year wheat spread is the highest in 10-20 cm which is almost the same.

Among the factors that influence the formation of soil fertility, it was determined that organic substance has a strong role and significance (V.G.Mineev, 1978). The physical, chemical and biological conditions of the soil impressively depend on the amount of organic substance in the soil.

The source of soil organic substances is a plants root system, as determined by the researchers.

We defined the national system weigh by monolith method during plant harvest period of 2015-2016. For the plants involved in the experiment, system spread is 69.9-124.06 c/ha in the 0-30 cm of soil depth at 2 years average. And it matches the results of other researchers. In terms of national system weight, rapeseed weight is the highest at 124.0 c/ha and peas weight is the lowest at the 69.9 c/ha as detected by the study.

The study conducted in Buryat, Russia revealed that wheat has national mass of 17-40.5 c/ha in the 0-40 cm depth depending on its antecedent whereas the study conducted in Belarus in 2011 detected that rapeseed has national mass of 15.9 c/ha.

This result is relatively lower than our study results and we consider that it is caused by the fact that plant's national weight increases in the dry climate. Also, the study conducted in Buryat, Russia presents that 4 field rotation which is fallow-rye-bananas rice- rapeseed brought 2 times higher national mass than unrotated wheat and wheat banners (A.P.Batudaev, V.B.Bohiyev, A.K.Ulanov, 2004). It confirms our study results which show that the national system weight of rapeseed is higher.

According to the research conducted at the Agricultural Academy of Buryat, fallow-wheat-wheat rotation brought national mass of 18.9 c/ha, sunflower-wheat-wheat rotation brought 26.8 c/ha mass and sunflower-wheat-grass rotation resulted 3.9 c/ha mass (40). But our study claims that the more the national spread is, the more the national mass will be (r=0.68).

IV. CRITICAL ANALYSIS

The researchers studied the effects of rapeseed fertilizing technology in the soil fertility by Dr. B.Baatartsol, N.Bayarsukh (2008-2011) indicated that when using the full minerals ($N_{15}P_{20}K_{20}$) and biological fertilizers, humus, nitrate azote, mobile phosphorus and exchanging calcium are increased by 0.52%, 2.92 mg/kg, 0.6 mg/100 gr and 9.0 mg/100 gr respectively. Our study also indicated that version calculated by the 30 t/ha area active substance resulted the highest harvest which is 17.3 c/ha and in the 40, 50kg/ha active substance version, the harvest was decreased by 3.0-5.3 c/ha.

V. CONCLUSION

1. The study results show that wheat banner harvest in the fallow-wheat- rapeseed bananas rice rotation was 6.5 c/ha. It is 2.3 c/ha lower than the harvest after the fallow and it determines that the rapeseed influence the harvest of wheat banner.
2. When planting the rapeseed after the fallow and leguminous plants, it brought yields of 9.3-10.3 c/ha. Comparing to the other antecedents, the yield is increased by 2.7-3.0 c/ha. It shows that the seed plants are not a good antecedent for the rapeseed.
3. The fact that national spread of rapeseed is 61.0-62.0% in its replanted version after the peas and wheat banner reveals that rapeseed leave national residuals with a low dependency to its antecedents.
4. When replanting rapeseed after fallow-wheat banners, the amount of humus is increased by 0.10-0.51% as compared to other versions, and the version of planting rapeseed after wheat in fallow-wheat- rapeseed -wheat banner rotation shows the intensity of soil fiber breakdown is 10.0-37.07% which means it is increased by 0.005-0.02mg per day.
5. According to the agrochemical analysis made in the field soil where the rapeseed were planted, the hummus was decreased with the highest reduction in the version used compound fertilizer ($N_{26}P_{18}$) 40 kg/ha active substances.

When fertilized by the compound fertilizer ($N_{26}P_{18}$) 30 kg/ha active substance, the seed harvest and biometric indicators of rapeseeds are being increased more than the versions of monitoring and other doses. The correlational analysis determined that the seed harvest is directly related to the 1000 seeds weight, number of product stems, number of fascicules in one plant, number of seeds, number of seeds in the fascicule ($r= 0.70-1.0$).

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AUTHORS

First Author – Densmaa Sanjaa, Doctoral candidate at Argo-ecology school of Mongolian University of Life Sciences, Ulaanbaatar Mongolia, densmaa@mndu.gov.mn
Second Author – Munkhjargal Ochirbat, Professor, Doctor of Science (Sc.D) of Argo-ecology school at Mongolian University of Life Sciences, ochirbat_munkhjargal@yahoo.com
Third Author – Amarsanaa Bayar, Professor, Ph.D of Argo-ecology school at Mongolian University of Life Sciences, amarsanaa_76@yahoo.com