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THE TECHNOLOGY OF BUCKWHEAT GROWING AS A PLANTING FILLER

Today it is a task to farmers to increase buckwheat production by expanding areas of buckwheat cultivation in intermediate crops because after cutting and stubble crops - an important reserve increase gross grain production efficiency and crop conditions for the agriculture sector intensification. Intermediate buckwheat crops have important economic and agronomic and economic importance. Obtaining two harvests a year from one field confirms the high intensity of management, thus increasing productivity per hectare to 30-80%. The paper deals with the results of experimental and industrial studies on improving of the existing technologies of buckwheat cultivation for grain, green manure, green fodder during the intermediate sowing. The technological aspects of straw and after-reaping straw residues using for organic fertilizers by means of "Vermistim-D" destructor produced by PE "Bioconversion" (Ivano-Frankivsk) and new generation organic fertilizers " Biohumus", "Bioproferm".

Keywords*: technology, buckwheat, after-mowing and after-reaping sowing, "Vermistim-D" destruction, " Biohumus", "Bioproferm", yields.*

Introduction. Buckwheat together with millet and rice belongs to the most important cereal crop. In agriculture it appeared 2500 years ago. In Ukraine it was widespread only in XV-XVI centuries. Until 1990 in Ukraine the annual sowing of buckwheat on the area of 400-500 thousand hectares completely provided the internal needs of the State and export, as well as the seeds for green manure, green fodder and as honey plant near the apiaries and in the gardens.

In 2000, 481 000 tons of buckwheat grain was produced from the area of 529 thousand hectares. Since 2001, the areas under buckwheat were annually diminished and in 2015 only 122,3 thousands hectares were planted and only 140,4 thousand tons of the crop were produced.

Several years ago the reduction in the buckwheat production has led to import of 20,000 tons from China.

So, the most important task of the farmers is to increase buckwheat production by the expanding of buckwheat cultivation areas during as a planting filler, because after-mowing and after-reaping sowing is an important reserve of the gross grain and crop production efficiency increase in conditions of the agronomy intensification.

Analysis of recent studies and publications discussing this problem. Intersowings of agricultural crops including buckwheat make it possible the efficient use of household tools and growing season during the whole year, they are the significant reserve of the crop production increase.

Similar buckwheat features such as: growing season shortness and comparative simplicity to the conditions of nutrients supply create preconditions for this crop culture in the intermediate growing. In the majority of regions where buckwheat is grown as the basic crop it may be cultivated in after-mowing and after-reaping sowing.

The opportunity and economic feasibility of buckwheat growing after harvesting was found in 1936 in research of a former Kyrgyz State Selective Station and Kyrgyz Research Animal Breeding Institute (T. M. Krestiannìkova, 1962) and then the harvested yield was 29,6 and 18,5 q/ha of grain.

The significant attention to the cultivation of crops in the intesowing in Ukraine has provided by Professor S.O. Vorobiov (1935), who scientifically proved the effectiveness of millet, buckwheat and other crops cultivation as planting fillers in conditions of Ukrainian Polissia, Forest-steppe and Steppe. The research of the after-mowing method of buckwheat growing performed by G.S. Kyiak and Y.I. Dedyshyn (1996) in the experimental fields of "Obroshyno" of the Institute of Agriculture in the Carpathian region (NAAS). They concluded that growing of buckwheat as a planting filler is quite real in terms of the Lviv region.

The research of O.S. Alekseieva (1981) found that compared with April and May after-mowing sowed buckwheat grows intensively, blossoms earlier, flowering and grain filling take place under favorable conditions. Plants pass light stage faster, so the summer buckwheat crops have shorter vegetation period from 12-15 days in Forest-steppe and Polissia and from 15-20 days in Steppe regions.

Sustainable buckwheat yields can be obtained by planting it after the crops that are harvested for green fodder. Such as winter rye, wheat, vetch-oat mixture, clover. After harvesting of these crops you can sow both fast-ripening and medium- ripening buckwheat varieties, which also have time to ripen in the frostless period. (A.V. Averchev, 2001)

In 70-s a lot of researchers of many scientific institutions, in particular of Kamianets-Podilskyi Agricultural Institute were involved in the selection and breeding of buckwheat varieties for after-mowing and after-reaping sowings. The average grain yield was 15,8-17,6 q/ha (V. Levenets, O.S. Gorash, A.I. Dìyanchuk, 1981).

By the results of long-term research it was established that the late buckwheat sowing have some advantages over the conventional spring. In after-mowing and after-reaping sowings buckwheat develops in more favorable conditions because the progress of the critical period of “flowering and grain formation“ occurs in the second half of the summer in moderate temperatures and relative air humidity, that positively affects the development and grain formation of plants (K. H. Populìdì, 1976).

Intermediate buckwheat crops are of great economic and agrotechnical importance. Obtaining two harvests a year from one field confirms the high intensity of management, thus increasing to 30-80% of productivity per hectare. Ecologically such crops sowings are indicators of arable land proper use. It is known that during summer planting, 75-80 days with the 1200-1600°C sum of active temperatures (above 10°C) are necessary for the formation of

common buckwheat varieties yields and 60-70 days with 800-1000°C temperatures sum are needed for fast-ripening varieties. In all soil-climatic zones of Ukraine there is still a significant amount of unused active temperatures for the development of buckwheat after harvesting winter crops (wheat, barley, rye), cabbages, alfalfa for green fodder. It is enough heat for the formation of a buckwheat yield during its planting after harvesting of early spring and winter ear-type cultures, rapeseeds, peas.

The amount of active unused temperatures for this period in the Western part of Forest-steppe is 1100-1200°C, in the Central and Eastern parts – 1300-1400°C, these are sufficient for maturing of mid ripening buckwheat varieties. Since buckwheat is actively growing and evolving in the average daily temperatures of 15-18°C, so period before sowing with a smaller provision of heat is not used. This period is particularly long in places with slow warming in spring. So the sowings after cutting are advisable to introduce in areas with long spring period – West Polissia and Forest Steppe. Here stable transition of daily average air temperature over 5°C occurs on April 2-9, over 10°C is only on April 25-29, and over 15°C is only on May 18-29, or respectively in 20-23 and 50-53 days after the restoration of the winter crops active growing period. In the eastern part of the country the optimal time of planting is limited by the significant probability of frosts in spring, which can damage buckwheat sprouts, having been sown in early periods. However, under such temperatures winter cereals, cabbages and other crops are actively germinating and forming the vegetative mass, which is a valuable fodder for cattle, especially in the early spring period. That is why the buckwheat sowing after the crops harvested mainly for green fodder are widely spread in its cultivation areas.

According to the Institute of Agriculture in the Carpathian Region (NAAS), Victoria sort sowed after cutting with the introduction of $N_{45}P_{60}K_{60}$, provided 13,8 q/ha of grain in average three years, and sowed as usual – 15,1 q/ha. Profit from after-mowing cultivation of buckwheat has reached to 641%, from usual type cultivation – 567% [1.6].

Productivity of buckwheat sowed after cutting is influenced greatly by fertilizers. For three years the average yield increase from the use of complete mineral fertilizer in $N_{30}P_{60}K_{60}$ dose was 1,0-2,8 q/ha, or 20-26%, and in some years it was much higher. In 1985 after winter rapeseeds, buckwheat sort Sumchanka achieved growth of 3,8 q/ha, sort Astra – 4,8 q/ha or respectively 31 and 38%. Yields of crops sowed after mowing is approaching to the level of basic yields in conditions of fertilizers adequate amounts application not only under the buckwheat but also under the main cultivation crop. Essential for after-mowing cultivation of crops is sorts high quality features. In particular, fast-ripening sort Stepova forms the harvest almost simultaneously and prevails other varieties in yields during the intermediate sowing. In production environment the buckwheat sowings after cutting also provide high yields. In a former farm "Lozovskyi" Kharkiv region the buckwheat yields were 24,7 q/ha using after-mowing cultivation, while the average buckwheat yields in the region were 10,1 q/ha of grain.

A shortage of buckwheat yields is noticeable after winter rye and wheat, legume-cereals mixtures; the yields increase from Southwest to Northeast. The shortage of buckwheat yields is significantly increasing in the result of untimely harvesting of the previous culture. Buckwheat sowing after its optimum terms restricts its value as a predecessor of rye and wheat. Therefore, to obtain high yields of the early ripening buckwheat sorts in the intermediate sowing you need to widely use only such predecessors that have been harvested in time. These are basically winter cabbages varieties. Buckwheat sowing after crops harvested later optimal terms of its planting should be considered as a reserve of buckwheat grain production increase. Therefore it is necessary to ensure the performance of all technological operations to maximize its productivity in basic crops.

In Forest-steppe and Steppe areas buckwheat may be grown both after-mowing and after-harvesting. From the previous crop harvesting to the period of frosts and cold weather,

sufficient time (80-100 days and more) remains for the active germination of heat-loving plants. In addition, in the second half of the summer there are ,favorable conditions for the buckwheat development, particularly on the irrigated lands.

At the Izmailska sort station in Odessa region buckwheat yields on irrigated lands (in average during 11 years) in all variants of the experiment was 19,8 q/ha (minimum – 10,4 q/ha), in other years – not less than 14,5 q/ha. The buckwheat is sown in the third decade of June (after shelling peas) and in the first-second decades of July (after winter barley and wheat). Flowering and pollination of these crops occurs in the second-third decades of August when the heat passes and temperature reduces a little.

Years of buckwheat cultivating experience in Scientific-Research Institute of Cereals named after O. Alekseieva of State Agrarian and Engineering University in Podillia demonstrated that the buckwheat yield in intermediate sowing could be harvested in three out of four years of cultivation. The average long-term yields for the optimal term of sowing is 17,7 q/ha, for after-mowing sowing is 13,6 q/ha, for after-reaping – 9,4 q/ha. In this case decisive is the genetic features of the variety. Stepova sort is the best in the intermediate sowing; its yields in after-mowing and after-reaping seedings are respectively 10,5 and 15,7 q/ha. Buckwheat intermediate sowing are recommend to be made immediately after harvesting of winter wheat for green fodder (after-mowing). Yelena and Stepova varieties are recommended for after-reapìng cultivation of buckwheat after winter rapeseeds with possibility of their extra use in honey production conveyor [1, 3, 5].

However, in recent years due to the rise of mineral fertilizers and other means prices, as well as a number of agricultural enterprises transition to the technology of organic agriculture, minimum tillage, acquisition of new machinery, units (combined machines for soil cultivation, straw other plant remains shredders, seeders for precision seeding space within 38 cm (wide-row), seeders for row space within 19 cm for direct sowing in stubble, etc.) buckwheat cultivation technology needs to be improved.

The aim of the research is to improve the existing technologies of buckwheat cultivation for grain, siderate, green fodder in intermediate sowings and to develop technology for the use of straw and after-mowing residues into organic fertilizers with the help of the "Vermistim-d" destructor.

Methodology. Experimental and production research is done at the experimental field of State Agrarian and Engineering University in Podilya, at private firm “Bohdan and company” of Ivano-Frankivsk district, at agro firm “Kolos” of Kyiv district, at corporation “Kolos-VS” of Ternopil district, the results of these scientific laboratories’ research for the period of 1936-2014 were generalized.

Modern sorts of buckwheat are used in the research. Such bio stimulators of growth for aerial top-dressing as “Vermyiodys” and “Vermymah”, bio preparation for stubble destruction “Vermystym-D”, liquid organic manure, such fertilizers as “Bioproferm” (8-15 t/ha) and “Biohumus” (3-4 t/ha) were utilized and turned over in the depth of 10-12 cm. The organic fertilizer “Bioproferm” with the balanced contents of trivalent chrome and plant spraying with growth regulator such as “Biokhrom” in the period of vegetation were used for getting dietary buckwheat grains.

Results. On the basis of the experimental and production research made during 2012-2015 and generalization of results of other scientific laboratories we have developed the technology of buckwheat cultivation both for green manure and grain as a planting filler, which is based on the realization of the following demands:

After-mowing buckwheat crops should be located on the area after winter crops, perennial herbs, gathered for green rich fodder or haylage, after-reaping buckwheat crops

should be sowed after harvesting autumn barley and other cereals, peas, brassicaceae, not later than July, 25-30. It is desirable to sow the buckwheat for green manure after July, 30;

In the process of forerunner-crop gathering it is important to make the destruction of straw and plant fragments with the help of bio preparation "Vermystym-D" with the minimal quantity of nitrogenous fertilizers (8-12 kg/ha) or with the help of manure (5-10 tn/ha), organic fertilizer such as "Biohumus" (3-4 tn/ha) taken in the result of vermicultivation or bio fermentation with simultaneous turning over the soil in the depth of 8-12 cm. After that you may sow the buckwheat with the next soil rolling. In the process of zero tilling buckwheat is sowed in the stubble without any destruction with the help of seeds surfaced by "Vermymag" (6 l/ha) in the depth of 2-4 cm.;

After-mowing buckwheat seeding rate is 2,2-2,5 million per hectare of similar seeds with the help of wide-row sowing and 3,5-4,0 million per hectare of similar seeds with the help of row sowing, in terms of after-reaping sowing the seeding rate is increased to 15-20%;

The crop maintenance includes the after-shoot harrowing, additional fertilizing in the period before buckwheat blossoming with complex bio stimulant and fertilizer "Vermymag" (7 l/ha) in the mixture with carbomide (1 kg/ha);

It is necessary to bring bee families at buckwheat sowing location, 2 or 3 days before buckwheat blossom time (2 or 3 families/ha);

To grow buckwheat in terms of organic farming using only mineral manure of natural origin such as phosphate manure and (kalimag); to use such organic manure as "Biohumus", "Bioactive" and biologicals such as liquid organic manure-bio stimulant "Vermymag" allowed in organic farming;

To use straw and plant fragments of buckwheat to create the mineral manure adding the bio destructor "Vermystym-D", taking into account the following scheme: 8-12 kg/ha of ammoniac saltpeter or 10 kg of urea, 10-12 kg of KAS are added to the basic solution. It is possible to use such liquid manure or fertilizer as "Biogumus" (3-4 t/ha), or "Bioproferm" (8-15 t/ha) turning them over in the soil in the depth of 10-12 cm.;

To grow buckwheat using the organic manure called "Bioproferm" which contains the balanced quantity of trivalent chromium and spraying the plants in the period of vegetation with growth regulator called "Biokhrom" for treating diabetes.

The obtained results were established within agrarian farming with different forms of ownership such as the private firm "Bohdan and Company" of Sniatynskyi district of Ivano-Frankivsk region, limited liability company "Ahrofirma "Kolos"" of Kyiv region, limited liability company "Korporatsiia "Kolos-VC" of Ternopil region.

The new biological technology that includes seed treatment of spring and autumn crops and double spraying of plants in the period of vegetation with the help of bio stimulators and fertilizers produced by private firm "Biokonversiia – "Vermymag", "Vermyiodys" is provided every year at the area (about 2000 hectares) of spring and autumn crops by private firm "Bohdan and Company" (manager, B.V. Tymofiichuk) of Sniatynskyi district of Ivano-Frankivsk region to improve soil fertility, to get the high quality and rich harvest and to cut down expenses for buying mineral manures and pesticides. The destruction of straw and plant fragments is done with the help of "Vermystym-D" on the area of 600-700 hectares combining the sowing crop for sideration (white mustard, oil black-radish, rye and buckwheat).

The buckwheat is sowed every year at the area of 105-220 hectares after harvesting autumn barley and we get 1,2-1,8 t of grain on the average. After gathering autumn barley with the help of John Deere 1590 seeder, the sort of buckwheat called "Ivanna" is sowed in stubble by seeds surfaced by bio stimulator "Vermymah" by row sowing with the distance between rows of about 19 cm and 50-80 kg/ha of highly concentrated mineral fertilizer in each row digging them into in the depth of 2-4 cm. At the beginning of buckwheat budding the plants are

sprayed by growth stimulator with a mixture of carbomid. 2 or 3 bee families are located at each hectare.

Both the process of destruction of autumn barley straw and buckwheat with the help of deconstruction "Vermistim-D" in tank mixture of carbamide (10 kg/ha) and the procedure of digging them into in the depth of 10-15 cm. take place after harvesting buckwheat grain.

The limited liability company "Korporatsiia "Kolos-VC"" of Ternopil district makes the buckwheat sowing after autumn barley grain harvest. The process of sowing takes place on July, 7-27 by VÄDERSTAD Rapid A 600 S seeder and SELEC and the seeding rate is about 100 kg/ha. And seed depth is 3-4 cm. The tillage before sowing includes adding mineral manure (100 kg/ha). 1or 2 bee families are brought at crops at the beginning of blossom time. In the process of harvesting the separate method is applied. From 2013 till 2014 the buckwheat crop capacity was 20-23 q/ha. The growth and progress of buckwheat sprouts stopped in the result of high temperature and lack of moisture in the soil in 2015.

The experiments of V.M. Sendetskoho at private firm "Bohdan and Company" of Ivano-Frankivsk region showed that taking a culture of buckwheat for siderate as a plant filler provided the heavy crop of green mass (280-357 q/ha) in combination with white mustard, oil radish.

The buckwheat is grown at agrofirm "Kolos" of Kyiv region at typical poorly loamy black soil as plant fillers in the after-stubble period and mowing every year at the area of 180-220 hectares and the plant gives 15-28 q/ha of crop.

The buckwheat crop (82-95 hectares) in the period after mowing is located after double mowing of lucerne, gathered for fodder and silage, with simultaneous ploughing in the depth of 20-22 and seed surfacing before sowing, the seeding rate of sort called "Deviatka" is 95-100kg/ha. After gathering buckwheat for grain the deconstruction of straw and plant fragments with simultaneous straw rolling in the depth of 10-15 cm with the help of CASE 5,4 seeder, 38 cm. of row spacing and seeding rate is 95-100 kg/ha. The deconstruction of straw and plant fragments after stubble with simultaneous turning over the soil in the depth of 10-12 cm after buckwheat harvest is done. The deconstruction of straw and after stubble plant fragments (barley 4-5 t/ha and buckwheat – 2-3 t/ha) are brought (30-35 t/ha) in equivalent proportions to the high quality compost.

Profitability of buckwheat growing as a planting filler was 85-372%.

Discussion. The importance of buckwheat for national agriculture, the accent on its growing as a planting filler in the after-mowing and after-reaping periods for increasing grain production and using green fragments for siderite, straw and plant fragments for manure were practically proved by the results of provided technology at the private firm "Bohdan and Company" of Ivano-Frankivsk region, corporation "Kolos-VS" of Ternopil region, and other agricultural enterprises. The study proved the importance of broadening the area of buckwheat growing both as basic crop and as a planting filler. This procedure will enable the increasing of buckwheat production and will assure home market with buckwheat and enter the world market. The usage of straw and buckwheat plant fragments improves the soil fertility and helps to avoid heavy expenses at buying pesticides and mineral manure.

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ТЕХНОЛОГІЯ ВИРОЩУВАННЯ ГРЕЧКИ В ПРОМІЖНИХ ПОСІВАХ

На сьогодні перед аграріями стоїть завдання збільшити виробництво гречки за рахунок розширення площ її вирощування у проміжних посівах, адже післяукісні і післяжнивні посіви – важливий резерв збільшення валового виробництва зерна і ефективності рослинництва за умов інтенсифікації галузі землеробства. Проміжні посіви гречки мають важливе господарсько-економічне та агротехнічне значення. Одержання двох врожаїв за рік з одного поля підтверджує високу інтенсивність господарювання, що дозволяє збільшити продуктивність одного гектара на 30-80%. Висвітлено результати експериментальних та виробничих досліджень з удосконалення існуючих технологій вирощування гречки на зерно, сидерат, зелений корм у проміжних посівах, технологічні аспекти використання соломи і післяжнивних решток соломи на органічні добрива з використанням деструктора «Вермистим-Д» виробництва ПП «Біоконверсія» (м. Івано-Франківськ) та органічних добрив нового покоління «Біогумус», «Біопроферм».

Ключові слова: *технологія, гречка, післяукісні і післяжнивні посіви, «Вермистим-Д», деструкція, «Біогумус», «Біопроферм», врожайність.*

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ТЕХНОЛОГИЯ ВЫРАЩИВАНИЯ ГРЕЧИХИ В ПРОМЕЖУТОЧНЫХ ПОСЕВАХ

На сегодня перед аграриями стоит задача увеличить производство гречки за счет расширения площадей ее выращивания в промежуточных посевах, ведь послеукосные и пожнивные посевы – важный резерв увеличения валового производства зерна и эффективности растениеводства в условиях интенсификации отрасли земледелия. Промежуточные посевы гречихи имеют важное хозяйственно-экономическое и агротехническое значение. Получение двух урожаев в год с одного поля подтверждает высокую интенсивность хозяйствования, что позволяет увеличить продуктивность одного гектара на 30-80%. Представлены результаты экспериментальных и производственных исследований по совершенствованию существующих технологий выращивания гречихи на зерно, сидераты, зеленый корм в промежуточных посевах, технологические аспекты использования соломы и пожнивных остатков соломы на органические удобрения с использованием деструктора «Вермистим-Д» производства ООО «Биоконверсия» (г. Ивано-Франковск) и органических удобрений нового поколения «Биогумус», «Биопроферм».

***Ключевые слова:** технология, гречка, послеукос и пожнивные посевы, «Вермистим-Д», деструкция, «Биогумус», «Биопроферм», урожайность.*