

**ПРОЕКТНА ПРОПОЗИЦІЯ НА УЧАСТЬ У КОНКУРСІ СПІЛЬНИХ  
УКРАЇНСЬКО – КИТАЙСЬКИХ НАУКОВО-ДОСЛІДНИХ ПРОЕКТІВ  
ДЛЯ РЕАЛІЗАЦІЇ У 2019 – 2020 рр.  
(Міністерство освіти і науки України)**

**APPLICATION FORM FOR THE CALL FOR PROPOSALS OF THE  
JOINT UKRAINE – THE PEOPLE’S REPUBLIC OF CHINA  
R&D PROJECTS FOR THE PERIOD OF 2019 – 2020  
(To be applied to the Ministry of Education and Science of Ukraine)**

**1. General information**

<b>Project</b>
<p>1. <b>Title:</b> Allocation of genotypes with an increased level of immune properties and soil drought resistance among modern assortment of soft winter wheat <b>Code of the state classification. Rubricator of scientific and technical information DC 022:2008:</b> 20 – agrarian sciences, 201 – agronomy, 202 – plant protection and quarantine</p> <p>2. <b>Aims and field of the project:</b> The purpose is to select the forms of soft winter wheat, which have an increased index of the implementation of the genetic potential of grain productivity, compared with an initial grade. The field of research is agrarian sciences, agronomy (plant selection), plant protection and quarantine (phytopathology, plant immunity)</p>

<b>Partners</b>	<b>Ukraine</b>	<b>China</b>
<b>1. Project leader (first and last name)</b>	Vlasenko Volodymyr Anatoliiovych	Li Chengwei
<b>2. Position</b>	SNAU, Head of the Department of Plant Protection, Doctor of Agricultural Sciences, Professor	President of Henan Institute of Science & Technology, PhD of Agricultural Sciences, Professor
<b>3. Institution</b>	Sumy national agrarian university (SNAU)	Henan Institute of Science & Technology (HIST)
<b>4. Address</b>	40021, Sumy, H. Kondratieva street, 160	Hualan road, Hongqi district, xinxiang city, Henan province
<b>5. Phone number, fax</b>	(+38-0542)70-11-04 (+38-099)3099-007	<b>+86 03733040626</b> <b>+86 03733693395</b>
<b>6. E-mail</b>	vlasenkova@ukr.net	lichengweiwau@hotmail.com

<b>7. Other team members (first and last names, position)</b>	Bakumenko Olha Mykolaivna Phd of Agricultural Sciences Osmachko Olena Mykolaivna Danko Yurii Ivanovych, Doctor of Economics, professor of the department	<b>Zheng Yu</b> , PhD of Phys. And Math. Sciences, Director of European Agrophysical (Xinxiang) Institute <b>Chen Bihua</b> , Phd of Agricultural Sciences, Consultant of European Agrophysical (Xinxiang) Institute
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## 2. Relevant publications (5 at most)

Ukraine	China
<p>1. About authorship on a plant variety Yuviliar Myronivskyi, soft wheat; Certificate № 09929 / V.A. Vlasenko, V.V.Kyrylenko, V.V.Shelepov, S.M.Marynka, S.O.Khomenko, H.S.Bassanets, V.T.Koliuchy, V.V.Morhun, V.F.Lohvynenko, I.P.Artemchuk. Application № 06007021.</p> <p>2. Vlasenko V. A. Selective evolution of myronivskykh wheat / [V. A. Vlasenko, V. S. Kochmarskyi, V. T. Koliuchy, L. A. Kolomiets, S. O. Khomenko, V. Y. Solona]; under. comp. Ed. V. A. Vlasenko. – Myronivka, 2012. – 330 p.</p> <p>3. Osmachko O.M. Regularities of inheritance of stability against the pathogen of mealy dew in F2 and F3 of soft winter wheat, created with the participation of varieties with wheat-rye translocations / O. M. Osmachko, V. A. Vlasenko // periodical of SNAU: Agronomy and Biology. – 2017. – Issue 2 (33) – P.145-151.</p> <p>4. Osmachko O.M. Characteristics of the Chinese assortment of soft winter wheat for resistance to brown rust in the conditions of the north-eastern forest-steppe / O. M. Osmachko, V. A. Vlasenko // periodical of SNAU: Agronomy and</p>	<p>1.Chengwei Li. Transcriptional, microscopic and macroscopic investigations into monogenic and polygenic interactions of tomato and powdery mildew. Wageningen Uiversity PhD thesis, October 2005. Printer: Posen &amp; Looijen b.v., Wageningen. (ISBN: 90-8504-307-7)</p> <p>2.Sun, Z., Liu, K., Zhang, J., Zhang, Y., Xu, K., Yu, D., ... &amp; Li, C. (2017). IAA producing <i>Bacillus altitudinis</i> alleviates iron stress in <i>Triticum aestivum</i> L. seedling by both bioleaching of iron and up-regulation of genes encoding ferritins. <i>Plant and Soil</i>, 1-11.</p> <p>3. Zhang, J., Yu, D., Zhang, Y., Liu, K., Xu, K., Zhang, F., ... &amp; Li, C. (2017). Vacuum and co-cultivation agroinfiltration of (germinated) seeds results in tobacco rattle virus (TRV) mediated whole-plant virus-induced gene silencing (VIGS) in wheat and maize. <i>Frontiers in Plant Science</i>, 8:393.</p> <p>4. Li XJ, Jiang XL, Chen XD, Song J, Ren CC, Xiao YJ, Gao XH, Ru ZG*. Molecular cytogenetic identification of a novel wheat-<i>Agropyron elongatum</i> chromosome translocation line with powdery mildew resistance. <i>PLoS ONE</i> 12(9): e0184462.</p> <p>5.ZhenGang Ru, LiPing Zhang, TieZhu Hu, HongYu Liu, QingKai Yang,</p>

<p>Biology. – 2016. – Issue 9 (32) – P. 133-140.</p> <p>5. Bakumenko O. M., Vlasenko V. A. Comparative estimation of grain productivity of soft winter wheat varieties with and without wheat-rye translocations in the conditions of the north-astern forest-steppe of Ukraine // periodical of SNAU: Agronomy and Biology. – Sumy, 2017. – Issue 9 (34)– P. 105-110</p>	<p>ManLi Weng, Bin Wang, ChangPing Zhao. Genetic analysis and chromosome mapping of a thermo-sensitive genic male sterile gene in wheat. Euphytica, 2015, 201(3): 321-327.</p>
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### **3. Background of the project (up to A4 1 page, min font 12)**

For increase in production of wheat grain it is necessary to continuously perform selection work concerning increase in an indicator of realization of genetic potential of grain productivity of plants. For this purpose, carry out studying of an ecology-genetic variety of samples of wheat of soft winter domestic and foreign selection (the grades introduced from China) by the genetic potential of resistance to diseases and better drought resistance, in particular soil, that ultimately provides high yields.

It is supposed to distinguish among the investigated samples the carriers of the introgressed component of rye (1RS), which are sources of Pm17, Lr24, Sr1AR genes, that provide increased plant immune properties. Besides, the rye genetic component in the wheat genome contributes to a better formation of the root system, which creates the preconditions for the formation of plants with increased resistance to soil drought. At the same time the overwhelming quantity of grades is such that consisting of a number of biotypes which have the different level of reaction to the environment and adjustable agronomical factors. It allows to select the best of them. By the improving selection is the opportunity to receive forms with the best economic and valuable signs and properties. Thus, by results of assessment of the allocated genotypes with high resistance to diseases and a soil drought, new forms of soft winter wheat will be created, that will provide to comparison with initial maternal forms the high level of realization of genetic potential of plants, further processing of which will lead to creation of new commercial varieties.

As a result, will be created lines of soft winter wheat with a group resistance to mushroom diseases (mealy dew, hard and dusty brand, brown rust, stem rust, in particular to the race of TTKSK strain of Ug99) with a high adaptive norm of reaction to the conditions of Ukraine, will be providing an increase of realization indicators of genetic potential of grain productivity. Their appointment - use in programs of creation of new varieties of soft winter wheat and their

introduction in production of high-quality grain for needs of the national economy of the country and also for export.

#### **4. Detailed description of the project (up to 2 pages)**

It is known that genotypes of soft wheat, which are carriers of wheat-rye translocations 1VL / 1RS and 1AL / 1RS, have increased resistance to plant diseases and pests-carriers of a number of viral diseases. In particular, 1AL/1RS translocation is the carrier of a number of identified resistance genes: *Gb2* – to biotypes B and C aphids; *Cm 3* – a mite *Aceria tosicheilla*; *Pm17* – mealy dew (pathogen – *Erysiphe graminis*); *Lr24* – brown rust (pathogen – *Puccinia recondita*); *Sr1AR* – stem rust (pathogen – *Puccinia striiformis*). The varieties with these translocations acquire widespread in the grain production of the countries of the world, including - in Ukraine, thanks to the presence of resistance against to phytopathogens. The inherited genes of resistance here thanks to the availability of rye component of the chromosome 1 RS.

At the same time the value of 1AL/1RS of wheat-rye translocation increases in comparison with 1BL/1RS, due to the *Sr1AR* gene. Soft wheat varieties with 1BL/1RS are carriers of a gene *Sr31* which provided resistance to all known races of stem rust practically until the end of the XX century. However, with the advent of race of *Ug99* (TTKSK) of stem rust, at first in Uganda (1999), then in Kenya, and now it is observed in crops of wheat of the countries of Central Asia and there is the threat of its further spread, the situation has radically changed as she virulent to *Sr31* and this gene lost its protective effect.

A number of methods have been proposed for identification of rye components in genomes of soft winter wheat - biochemical, cytological, with the help of DNA markers. Affordable, relatively simple and convenient is considered the method of an electrophoresis of alcohol-soluble spare proteins of grain of soft wheat in acidic environment. It is known that on the short shoulders of the chromosomes of first homologous groups of soft wheat are polymorphic loci, which encode alcohol-soluble spare protein grains - gliadins. The short shoulder of rye 1R chromosome contains a cluster of genes, that encode prolamins of rye - secalins. Consequently, a marker of 1AL/1RS of translocation is the presence on the electrophoregram of alcohol-soluble proteins of grains of the characteristic component block, which was designated as *Gli-A1w* (*Gld 1A17*).

Currently, in the State Register of Plant Varieties, suitable for distribution in Ukraine, there are several such carriers of wheat-rye translocations. In particular, the carriers of 1AL / 1RS translocation among them are Smuhlianka, Columbiia, Zolotokolosa and some others. Under pressure of natural mutational factors in production and selective sowing such varieties can accumulate biotypic composition of forms, that have received adaptive changes. These biotypes can

have advantages on adaptive norm of reaction when forming elements of productivity, so - to be perspective for creation of new competitive varieties. So, having involved late terms of sowing in the conditions of the northeast Forest-steppe, it will be necessary to make selection of biotypes in varieties with PZhT, and laying of new lines of sibs. The more effective method of creating a new valuable initial material will be involving of genotypes from the 1AL / 1RS translocation in crossing with the best modern Ukrainian varieties of different ecological and geographical origin. By the previous researches were received such hybrid populations which are at a stage of studying F4-F5. An individual selection of spikes from hybrid populations of the fourth and fifth generations, created with participation in crossings of parental forms that are carriers of PZHT 1AL / 1RS translocation, will allow to obtain constant lines.

he next stage will be the reproduction of the lines (F5-F6) in the field conditions of the northeastern forest-steppe and the evaluation of resistance to mealy dew, brown rust and septoriosiis under conditions of a natural infectious background using the varieties - accumulators of an infection of these phytopathogens. At the same time, it is necessary to conduct phenological observations and allocation of the best lines for morph physiological features, evaluation of the elements of grain productivity in selections and lines.

By the method of electrophoresis of alcohol-soluble spare protein proteins in the acidic medium will be carried out identification of the rye translocation of 1AL / 1RS in the selection lines (F5-F6). The identification results will provide grounds for dedicated the lines with the *Pm17*, *Lr24*, and *Sr1AR* genes.

Dedicated lines by a complex of economic and valuable signs, with the identified genes of resistance will be involved in selection work on creation of new varieties of soft winter wheat and spring in SNAU and transferred samples of seeds for attraction to similar programs of Mironovsky institute of wheat of V.M. Remesla, Breeding and Genetics Institute - Center of Seed Science and Cultivar Studies and others.

The results of the NTR will be presented in the final report in accordance with the current normative documents, in particular SSU 3973-2000 "System for the development and supply of products for production. Rules for carrying out scientific research works. General Provisions », etc.

## **5. Expected results to be achieved (up to 1 page)**

Will be created lines of soft winter wheat with a group resistance to mushroom diseases (mealy dew, hard and flying smut, rust, brown rust, in particular to the race TTKSK strain *Ug99*). Dedicated lines will have an introgressive component of rye (1RS), a carrier of genes *Pm17*, *Lr24* and *Sr1AR*, mounted in different genofons of the best modern varieties of soft winter wheat –

Kryzhynka, Rozkishna, Epokha Odeska and others with a high adaptive rate of reaction to the conditions of the north-eastern forest-steppe of Ukraine, which will provide an increase the performance of the genetic potential of grain productivity. Seed lines will be transferred to the National Center of Genetic Resources of Ukraine, as well as profile selection institutions (Institute of Plant Science named after V.Ya. Yurieva NAAS, Mironovsky institute of wheat of V.M. Remesla NAAS, Breeding and Genetics Institute - Center of Seed Science and Cultivar Studies, NC «Institute of Agriculture» NAAS and others) for use in programs for the creation of new varieties of soft winter and spring wheat and their introduction in the production of high quality grain for the needs of the national economy of Ukraine, as well as for export.

The selection lines received by group of authors, certainly, will be used in selection programs for creation of new varieties of soft winter wheat and spring wheat in profile institutions of Ukraine.

New varieties as a result of the State variety inspection will have a guaranteed increase in grain yield to a national standard of at least 2 centners / ha due to the increase of adaptive potential, which is part of the group's resistance to disease. If the newly-created variety will occupy a minimum crop area of 7 thousand hectares (0.1% to the total), then the additional grain collection, due to improved performance of the genetic potential of productivity, will be 1400 tons. That is, the revenue in the year will be more than 4 million UAH. In addition, the cost production of this grain will be lower due to saving on the chemical protection of crops sowing from diseases and technological operations. In this regard, the ecological factor at the expense of reducing the pesticide load will also be important for society and the environment.

#### 6. Stage plan of works (up to 4 pages)

№ of stage	Stages of work execution including the stages of the collaborator's work	Execution term (beginning - ending), month, year	Scientific and technical products and other materials subject to delivery to the customer, including the name of the co-executor's product	Cost of work in stages, including the volume of work of the co-executor, thousand UAH
1	2	3	4	5
1	Conducting of a patent-license search	I-IV months, 2019 p.	The section of the annual report	35 thsd UAH
2	Conducting of phenological observations of the investigated material	IV-VI months, 2019 p.	The section of the annual report	49 thsd UAH
3	Estimation of degree of defeat of investigated numbers by phytopathogens	V-VI months, 2019 p.	The section of the annual report	140 thsd UAH

4	Carrying out group and individual selections of the best forms on a complex of selection signs	V-VII months, 2019 p.	The section of the annual report	70 thsd UAH
5	Estimations of grain efficiency of the received selections / lines	VII-VIII months, 2019 p.	The section of the annual report	70 thsd UAH
6	Selection of seed samples from hybrid populations for biochemical analysis	VIII months, 2019 p.	Part of the section of the annual report	21 thsd UAH
7	Preparation of selections for sowing in the fall of 2018	VIII months, 2019 p.	Part of the section of the annual report	35 thsd UAH
8	Sowing of best numbers	IX months, 2019 p.	Part of the section of the annual report	105 thsd UAH
9	Conducting of biochemical analysis of samples from hybrid offspring	IX- XI months, 2019 p.	Part of the section of the annual report	140 thsd UAH
10	Writing an annual report	XI-XII months, 2019 p.	Report for 2019 year	35 thsd UAH
<b>Total for the first year</b>				700 thsd UAH
11	Selection of seed samples from lines of sibs of variety-carriers of 1AL / 1RS wheat-rye translocations	II months, 2020 p.	Supplementing the section of the report for 2019 and generalization of data	35 thsd UAH
12	Conducting biochemical analysis of lines of sibs of varieties with 1AL / 1RS translocation	II-IV months, 2020 p.	Supplementing the section of the report for 2019 and generalization of data	105 thsd UAH
13	Conducting of a patent-license search	I-III months, 2020 p.	Supplementing the section of the report for 2019 and generalization of information	35 thsd UAH
14	Conducting of phenological observations of the investigated material	IV-VI months, 2020 p.	Supplementing the section of the report for 2019 and generalization of information	70 thsd UAH
15	Estimation of degree of defeat of investigated numbers by phytopathogens	V-VI months, 2020 p.	Supplementing the section of the report for 2019 and generalization of information	70 thsd UAH
16	Estimations of lines on a phenotype and carrying out high-quality weeding	VI-VII months, 2020 p.	The section in the final report	70 thsd UAH
17	Estimations of grain efficiency of the received selections / lines	VII months, 2020 p.	Supplementing the section of the report for 2019 and generalization of data	70 thsd UAH
18	Selection of seed samples from selected lines of hybrid origin to confirm the presence of wheat-rye translocation of 1AL / 1RS - carrier of the genes <i>Pm17</i> , <i>Lr24</i> and <i>Sr1AR</i>	VIII months, 2020 p.	Supplementing the section of the report for 2019 and generalization of data	35 thsd UAH
19	Conducting of biochemical analysis of lines of hybrid origin	VIII-X months, 2020 p.	Supplementing the section of the report for 2019 and generalization of data	105 thsd UAH

20	Transfer of samples of seed lines to leading institutions for the creation of varieties	X months, 2020 p.	Copies of references of introduction	35 thsd UAH
21	Writing the final report	XI-XII months, 2020 p.	Final report	70 thsd UAH
<b>Total for the second year</b>				700 thsd UAH
<b>Total</b>				1400 thsd UAH

## 7. Exchange within the framework of the project

### Visit - stay in Ukraine

First and last name, position	Purpose of visit	Year	Number of days
LI chengwei ,Master	Organization of field and laboratory research	2019	14
		2020	14
Ru zhengang, assistant	Conducting field and laboratory research	2019	14
		2020	14
Li Dongxiao, assistant	Conducting field and laboratory research	2019	14
		2020	14
Li Gan, assistant	Conducting field and laboratory research	2019	14
		2020	14
Liyongchao, assistant	Conducting field and laboratory research	2019	14
		2020	14

### Visit - stay in China

First and last name, position	Purpose of visit	Year	Number of days
Vlasenko Volodymyr Anatoliiovych SNAU, Head of the Department of Plant Protection	Organization of field and laboratory research	2019	14
		2020	14
Bakumenko Olha Mykolaivna, assistant	Conducting field and laboratory research	2019	14
		2020	14
Osmachko Olena Mykolaivna, assistant	Conducting field and laboratory research	2019	14
		2020	14
Danko Yurii	Organization of the	2019	14

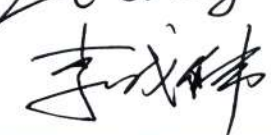



Ivanovych, Vice- rector on scientific work of SNAU	implementation of calendar tasks, field and laboratory research		
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## 8. Budget

Types of expenses	1st year	2nd year
<b>Direct costs</b>	<b>980000</b>	<b>980000</b>
• Labor costs, including taxes	490000	490000
• Materials and reagents	56000	56000
• Travels	280000	280000
• Other direct costs	7000	7000
<b>Indirect costs (up to 30% from labor costs)</b>	<b>147000</b>	<b>147000</b>

## 9. Signatures

Project leaders	Ukraine	China
1. First name and last name 2. Date 3. Signature	Volodymyr Vlasenko	<i>Li dengwei</i> 
<b>Institution</b>		
1. Name of institution 2. Head of institution 3. Date 4. Signature 5. Stamp	1. Sumy National Agrarian University 2. Volodymyr Ivanovych Ladyka	

### Attached the CVs of the project leaders

**Vlasenko V. A.** Doctor of Agricultural Sciences, Professor of Department of Plant Protection. For 35 years of academic experience, 287 scientific works have been published, including 2 monographs, 7 textbooks and study guides. In total, with the participation of Vlasenko V. A., 63 wheat varieties were created: soft winter – Myronivska early ripening, Kryzhynka, Remeslivna, Demetra, Podolianka, Columbiia, Kyivska 7, Kyivska 8, Smuhlianka, Pereislavka, Volodarka, Vesnianka, Dobirna, Lasunia, Favorytka, Bohdana, Pyvna, Zolotokolosa, Kalynova, Yuviliar myronivskyyi, Kolos Myronivshshyny, Ecomonka, Yasnohirka, Hazarka, Dostatok, Pamiati Remesla, Nataalka, Myronivska 32, Eksprompt, Unikum, Slavna, Spasivka, Svitanok myronivskyyi and others; soft spring – Kolektyvna 3, Elehiia myronivska,

Etiud, Siuita, Struna myronivska, Simkoda myronivska and others; firm spring – Izolda, Zhyzel, Diana. For breeding developments, 42 author's certificates for plant varieties and 9 patents have been obtained. Dedicated in co-authorship highly productive, valuable and strong in grain quality, adapted to the conditions of the forest-steppe, and also some to the conditions of Polissya and Steppe of Ukraine, the wheat varieties: soft winter - 49, from which 21 are entered in the State Register of Plant Varieties, suitable for distribution in Ukraine in 2017 and 3 are undergoing state testing; soft spring - 11, of which 7 are entered in the State Register of Plant Varieties in 2017 and 2 are under state testing; firm spring – 3, which are entered in the State Register of Plant Varieties. According to the statistics of the last 4 years, wheat varieties, created with the participation of Vlasenko V.A., were introduced in production on a total area of about 1 million hectares.

He is a member of the editorial boards of 3 professional scientific publications recognized by the Ministry of Education and Science of Ukraine: