Healthy Land
BIOPREPARATIONS

BTU-CENTER
UKRAINIAN BIOTECHNOLOGY

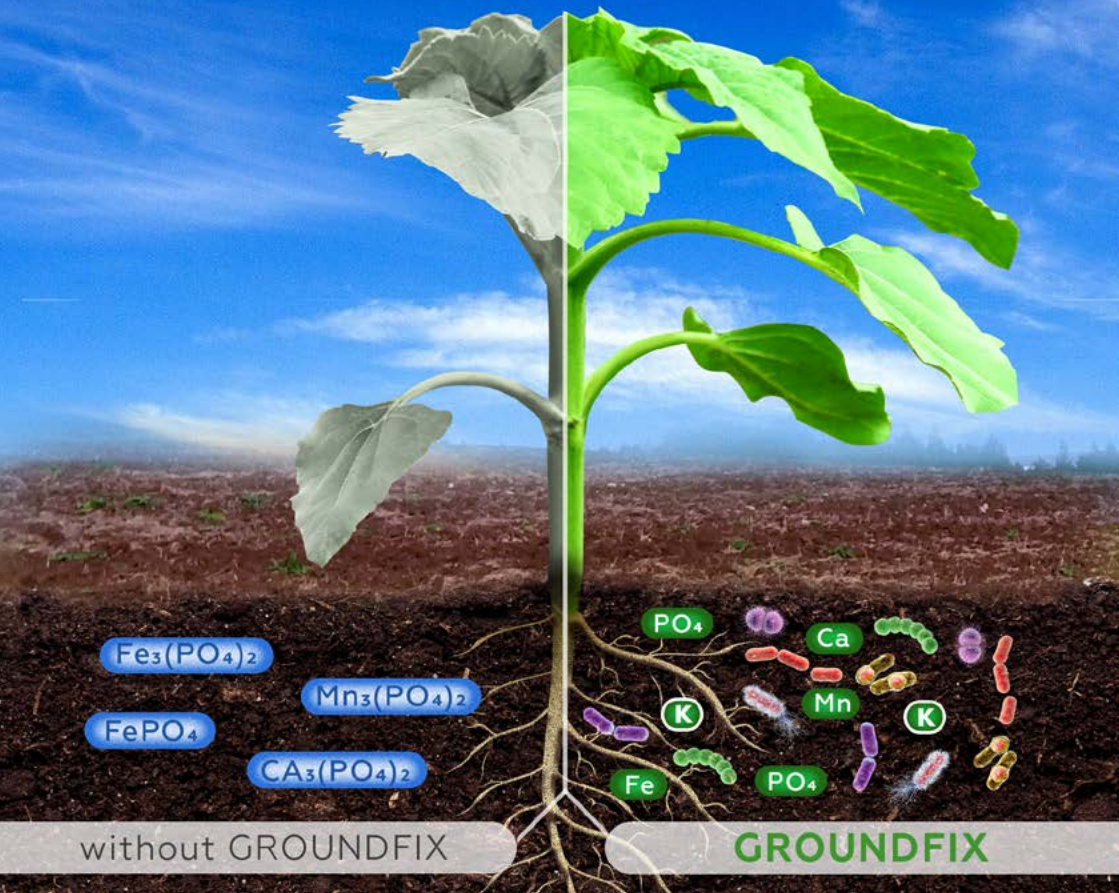
GROUNDFIX

ENHANCES NPK ASSIMILATION

PK – MOBILIZATION

ENHANCES PHOSPHORUS mobility and **POTASSIUM** availability in soil and mineral fertilizers

The recommended application rate of the **MINERAL FERTILIZERS** can be reduced by 30%



without GROUNDFIX

GROUNDFIX

Groundfix® has a COMPLEX composition:

Bacillus subtilis — aerobic bacteria capable of mobilizing phosphorus from organic and mineral compounds, fixing molecular nitrogen from the atmosphere. Bacteria produce biologically active substances that increase plant immunity, promote the destruction of complex organic compounds in the soil.

Bacillus megaterium var. Phosphaticum — bacteria able to release phosphorus bounded in organic and mineral compounds. Produces the enzyme silicase which helps to increase the mobility of silicon and potassium fixed by soil minerals.

Paenibacillus polymyxa — aerobic bacteria, which produce phosphatase, ensure the availability of mineral and organic soil phosphates for plants. Bacteria secrete phytohormones, a wide range of lytic enzymes that improve plant immunity promoting their growth and development. The exopolysaccharides produced by them have a positive effect on the structure of the soil, its aeration and moisture supply.

Enterobacter — bacteria capable of binding atmospheric nitrogen, improving the phosphate regime of the soil, increasing the availability of phosphates by plants, as well as producing phytohormones and biopolymers. Bacteria are effective in bioremediation of industrially contaminated soils.

Azotobacter — free-living bacteria that fix molecular nitrogen in the atmosphere and produce phytohormones that promote plant growth and development, including root system. Bacteria are capable of biodegradation of chlorinecontaining aromatic compounds, including pesticide residues. The exopolysaccharides produced by bacteria can mobilize heavy metals, converting them into inaccessible to plants form.

What makes Groundfix different from other preparations?

Bacteria in the composition of Groundfix synthesize:

carboxylic acids | amino acids | polypeptides | polysaccharides | enzymes | phythormones | vitamins

As a result, we observe the following:

Conversion of calcium phosphates (CA_3 $(PO4)_2$ into soluble form	Release of phosphorus from aluminum and iron phosphates ($AlPO_4$, $FePO_4$)	Release of phosphorus fixed by secondary minerals -hydroxides of silicon, iron, aluminum, and manganese in crystalline form
Release of potassium from minerals	Increasing silicon mobility and availability to plants	
Fixing atmospheric nitrogen and converting it into the form available to plants	Biodegradation of chlorine-containing aromatic compounds, including pesticide residues	Improving soil structure and moisture availability

Methods of application

During primary tillage

During pre-sowing cultivation

Row fertilization when sowing

Early spring feeding with liquid fertilizers

Fertigation

Crop	Period of treatment	Groundfix, l/ha	Working solution
Integrated farming			
Winter and spring cereals	Early spring, pre-sowing	3,0	100-200
Winter rapeseed	Early spring, pre-sowing	3,0-5,0	100-200
Sunflower Corn Soybean	Pre-sowing	3,0-5,0	150-200
	Row fertilization	0,5-1,0	20-50
Horticultural Vegetables	Fertigation, 2-3 treatments	3,0-5,0	Water application rate
Organic farming			
Winter and spring cereals	Early spring, pre-sowing	3,0-5,0	150-200
Winter rapeseed	Early spring, pre-sowing	5,0-8,0	
Sunflower Corn Soybean	Pre-sowing	5,0-10,0	
	Row fertilization	0,5-1,0	20-50
Horticultural Vegetables	Fertigation, 2-3 treatments	3,0-5,0	Water application rate

On-farm researches of effectiveness

1. Groundfix efficacy on sunflower applied in pre-sowing cultivation

Location: **Talalaivka district, Chernihiv, Ukraine**
Soil: **typical chernozem**
Sunflower: **sunflower**
Preceding crop: **winter wheat**

Research method

Application method	Preparation	Application rate
Pre-sowing soil cultivation	**Groundfix + UAN**	**3,0 l/ha**
	Control (UAN)	–

Research result

	Yield, t/ha		Yield increase compared to the control plot, t/ha
Sunflower	Opt. 1.	Control	Opt. 1.
Sunflower	**4,78**	**4,3**	**0,48** ✓

2. Effectiveness of Groundfix with Liposam applied in-furrow during sowing of sunflower

Location: **Kozova district, Ternopil region, Ukraine**
Soil: **typical chernozem**
Crop: **sunflower**

Research method

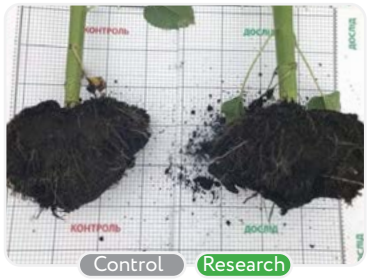
Application method	Preparation	Application rate
In-furrow	**Groundfix + Liposam**	**0,75 l/ha + 0,5 l/ha**
	Farm's method (control)	–

Research result

	Yield, t/ha		Yield increase compared to the control plot, t/ha
Crop	Research	Control	
Sunflower	**4,01**	**3,70**	**+ 0,31** ✓

3. Groundfix efficacy in pre-sowing cultivation on sunflower

Location: **Bohuslav district, Kyiv , Ukraine**
Soil: **typical chernozem**
Crop: **sunflower, variety Kondi**
Preceding crop: **winter wheat**



Research method

Application method	Preparation	Application rate
Pre-sowing soil cultivation	**Groundfix**	**5,0 l/ha**
	Farm's method (control)	–

Research result

Crop	Yield, t/ha: Research	Yield, t/ha: Control	Yield increase compared to the control plot, t/ha
Sunflower	**4,27**	**3,66**	**+0,61** ✓

4. Aftereffect of Groundfix on yield of corn, applied before sowing of sunflower

The same field next season
Crop: **corn, Pioneer 9241 hybrid**
Preceding crop: **sunflower**

Research method

Application method	Preparation	Application rate
Treatment of the **preceding crop in 2018**	**Groundfix**	**5,0 l/ha**
Pre-sowing soil cultivation	Control	–

Research result

Crop	Yield, t/ha: Research	Yield, t/ha: Control	Yield increase compared to the control plot, t/ha
Corn	**15,74**	**15,44**	**+0,30** ✓

5. Aftereffect of Groundfix + UAN on corn, applied early spring on winter wheat

Location: **Chernihiv region, Ukraine**
Soil: **grey forest sandy loamy, pH: 5,6-5,9**
Crop: **corn**
Preceding crop: **winter wheat**

Research method

Application method	Preparation	Application rate
Aftereffect	Groundfix + UAN	3,0 l/ha
Early spring fertilisation	Control	–

Research result

	Yield, t/ha		Yield increase compared to the control plot, t/ha
Crop	Research	Control	
Corn	11,32	10,86	+ 0,46

Results of soil sample analysis

Variant	Trial	Control	Trial	Control
year	17.06.2020		02.06.2021	
Exchangeable acidity, pH saline	5,9	5,6	5,4	5,8
Organic matter content converted to HUMUS %	1,72	1,26	1,68	1,35
Hydrolysed Nitrogen mg/kg	87,5	80,5	72,8	56,5
Mobile Phosphorus, P_2O_5 mg/kg	306,2	138,8	157,5	112,5
Mobile Potassium, K_2O mg/kg	179,5	44	110,0	52,5

6. Effect of Groundfix + UAN application between the rows (9-leaf) on corn

Location: **Kyiv region, Ukraine**
Soil: **typical chernozem**
Crop: **corn**
Preceding crop: **corn**

Research method

Application method	Preparation	Application rate
Incorporation in the row 9-leaf	Groundfix + UAN	3,0 l/ha
	Control	–

Research result

	Yield, t/ha		Yield increase compared to the control plot, t/ha
Crop	Research	Control	
Corn	11,86	11,60	+ 0,26

Results of soil sample analysis

Variant	Trial	Control
year	17.06.2020	
Exchangeable acidity, pH saline	5,6	5,4
Organic matter content converted to HUMUS %	3,42	3,48
Hydrolysed Nitrogen mg/kg	106,4	109,9
Mobile Phosphorus, P_2O_5 mg/kg	260,0	234,0
Mobile Potassium, K_2O mg/kg	86,2	68,8

7. Enhancement of Ecostern with Groundfix before the main tillage on corn

Location: **Khmelnytskyi, Ukraine**
Soil: **Chernozem fertilized by ash, pH -6.0**
Crop: **corn**
Preceding crop: **corn**
Date of sowing: **04.22.2018**
Date of harvesting: **11.06.2018**
Area of each plot: **5ha**

Research method

Application method	Preparation	Application rate
For the main tillage	Opt. 1 Ecostern/UAN32	1,5 l/ha 15 l/ha
	Opt. 2 Ecostern/GROUNDFIX/UAN32	1,5 l/ha 3 l/ha 15 l/ha
	UAN32 (Control)	15 l/ha

Research result

Crop	Yield, t/ha: Opt. 1	Yield, t/ha: Opt. 2	Yield, t/ha: Control	Yield increase compared to the control plot, t/ha	
Corn	11,52	11,83	11,10	+ 0,42	+0,73

8. Effectiveness of applying Groundfix with Mycofriend in-furrow on corn

Location: **Volyn region, Ukraine**
Soil: **sod podzol, pH: 6,3**
Crop: **corn**
Preceding crop: **winter wheat**
Area of plot: **78 ha**

Research method

Application method	Preparation	Application rate
In-furrow	Groundfix/Mycofriend	0,5 l/ha 0,25 l/ha
	Farm technology (control)	–

Research result

Sunflower	Yield, t/ha: Research	Yield, t/ha: Control	Yield increase compared to the control plot, t/ha
Corn	14,88	14,15	+0,73 ✓

9. Effectiveness of applying Groundfix for pre-sowing cultivation in corn monoculture

Location: **Lviv region, Ukraine, 2018**
Soil: sod-podzol
Crop: **corn**
Preceding crop: **corn**

Research method

Application method	Preparation	Application rate
For pre-sowing cultivation	Groundfix	5,0 l/ha
	Farm's method (control)	–

Research result

Crop	Yield, t/ha: Research	Yield, t/ha: Control	Yield increase compared to the control plot, t/ha
Corn	8,00	7,61	+0,39

10. Effectiveness of applying Groundfix with UAN for early spring fertilization on winter wheat

Location: **Chernigiv region, Ukraine**
Soil: **light grey, pH: 5,4-5,5**
Crop: **winter wheat**
Preceding crop: **sunflower**

Research method

Application method	Preparation	Application rate
Early spring fertilisation	Groundfix + UAN	3,0 l/ha
	Control	–

Research result

Crop	Yield, t/ha: Research	Yield, t/ha: Control	Yield increase compared to the control plot, t/ha
Winter wheat	6,19	5,47	+0,72

Results of soil sample analysis

Variant	Trial	Control
year	26.05.2021	
Exchangeable acidity, pH saline	5,5	5,4
Organic matter content converted to HUMUS %	1,84	1,23
Hydrolysed Nitrogen mg/kg	90,5	74,7
Mobile Phosphorus, P_2O_5 mg/kg	189,0	57,5
Mobile Potassium, K_2O mg/kg	97,5	60,0

11. Study of enhancement of Ecostern and UAN with the use of Groundfix in beforesowing cultivation

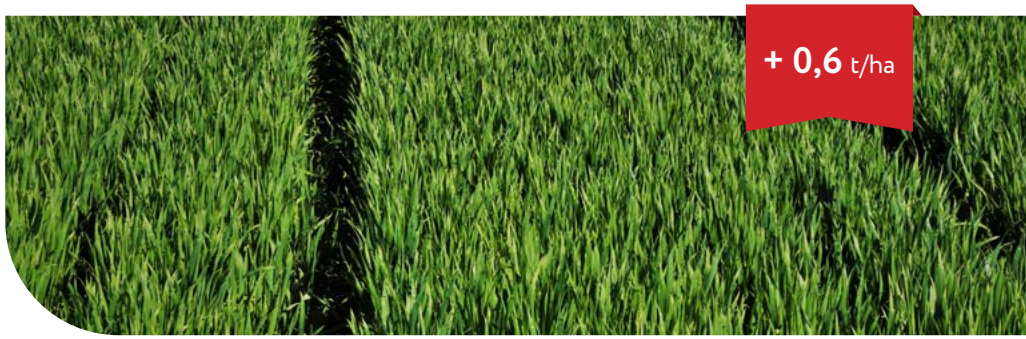
Location: **Ternopil region, Ukraine**
Soil: **chernozem fertilized by ash**
pH: 5,6
Crop: **winter wheat**
Preceding crop: **sunflower**

Research method

Application method	Preparation	Application rate
For the main tillage	Ecostern/UAN32	2.0 l / ha + 40 kg / ha
For pre-sowing cultivation	Groundfix	5 l/ha
For the main tillage	Ecostern + UAN32 (control)	2.0 l / ha + 40 kg / ha

Research result

Crop	Yield, t/ha: Research	Yield, t/ha: Control	Yield increase compared to the control plot, t/ha
Winter wheat	5,19	4,16	+1,03



12. The impact of Groundfix in presowing cultivation on winter wheat yield

Location: **Cherkasy region, Ukraine**
Soil: **typical chernozem**
Crop: **winter wheat**
Preceding crop: **winter oilrape**

Research method

Application method	Preparation	Application rate
For pre-sowing cultivation	Groundfix	4,0 l/ha
	Control	–

Research result

Sunflower	Yield, t/ha: Research	Yield, t/ha: Control	Yield increase compared to the control plot, t/ha
Winter wheat	8,2	7,6	+0,6

13. 2-years study of the effectives of Groundfix and Azotohelp on winter wheat applied in presowing cultivation (research station)

Location: **Ukraine, Institute of Feed Research and Agriculture of Podillya NAAS, Khmelnytsky region 2021-2022**
Soil: **weakly podzolized low-humus chernozem, pH - 5,8–6,2**
Crop: **winter wheat**
Preceding crop: **winter oilrape**

Research method

Application method	Preparation	Application rate
For the main tillage	Opt. 1 **Groundfix**	3,0 l/ha
For pre-sowing cultivation	Opt. 2 **Groundfix + Azotohelp**	1,5 l/ha +1,5l/ha
For the main tillage	Control	–

Research result 2021

	Yield, t/ha			Yield increase compared to the control plot, t/ha	
Crop	Research 1	Research 2	Control		
Winter wheat	5,84	6,27	5,34	+0,5	+0,93

Research result 2022

	Yield, t/ha			Yield increase compared to the control plot, t/ha	
Crop	Research 1	Research 2	Control		
Winter wheat	6,65	6,95	5,99	+0,66	+0,96

14. Trials on potato with -20% of fertilizers

Country: **Germany**
Crop: **potato**

Research method

	Application date:	Mineral fertilizers	BTU-CENTER biologicals	Application rate
Control	26.04.2021	100% of mineral fertilizers	-	-
Research	26.04.2021	80% of mineral fertilizers	-	-
	26.04.2021	-	Presowing soil cultivation + Groundfix	1,5 l/ha
	28.04.2021		Sowing + Mycofriend	0,8 l/ha
	01.06.2021		1st apply of Azotohelp	0,5l/ha
	17.06.2021		2nd apply of Azotohelp	1,0 l/ha
	09.10.2021		Harvesting	

Research result

	Yield, t/ha		Yield increase compared to the control plot, t/ha
Crop	Control	Research	
Potato	39,52	44,24	+4,72

Starch

Starch, %		Starch, t/ha		+ to control, t/ha
Control	Research	Control	Research	
23,00	23,55	9,09	10,42	+1,33

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