

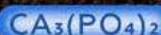
GROUNDFIX

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:

What makes Groundfix different from other preparations?

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 chlorine-containing aromatic compounds, including pesticide residues. The exopolysaccharides produced by bacteria can mobilize heavy metals, converting them into inaccessible to plants form.

Bacteria in the composition of Groundfix synthesize:

carboxylic acids

amino acids

polypeptides

polysaccharides

enzymes

phytohormones

vitamins



As a result, we observe the following:

Conversion of calcium phosphates ($Ca_3(PO_4)_2$) 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	
Winter rapeseed	Early spring, pre-sowing	5,0-8,0	150-200
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

Sunflower	Yield, t/ha		Yield increase compared to the control plot, t/ha
	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

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



+ 0,46 t/ha

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

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

Results of soil sample analysis

Variant	Trial		Control	
	17.06.2020	02.06.2021	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 ₂ O ₅ mg/kg	306,2	138,8	157,5	112,5
Mobile Potassium, K ₂ O mg/kg	179,5	44	110,0	52,5



+ 0,26 t/ha

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

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

Results of soil sample analysis

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



+ 0,42 t/ha
+ 0,73 t/ha

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

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



+ 0,73 t/ha

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		Yield increase compared to the control plot, t/ha
	Research	Control	
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		Yield increase compared to the control plot, t/ha
	Research	Control	
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		Yield increase compared to the control plot, t/ha
	Research	Control	
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 ₂ O ₅ mg/kg	189,0	57,5
Mobile Potassium, K ₂ O mg/kg	97,5	60,0



+ 1,03 t/ha

11. Study of enhancement of Ecostern and UAN with the use of Groundfix in before-sowing 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		Yield increase compared to the control plot, t/ha
	Research	Control	
Winter wheat	5,19	4,16	+1,03



+ 0,6 t/ha

12. The impact of Groundfix in pre-sowing 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		Yield increase compared to the control plot, t/ha
	Research	Control	
Winter wheat	8,2	7,6	+0,6



2021
+ 0,5 t/ha
+ 0,93 t/ha

2022
+ 0,66 t/ha
+ 0,96 t/ha

13. 2-years study of the effectiveness 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

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

Research result 2022

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



+ 4,72 t/ha

14. Trials on potato with -20% of fertilizers

Country: **Germany**

Crop: **potato**



Control

Research

Research method

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

Research result

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

Starch

Control	Starch, %		Control	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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