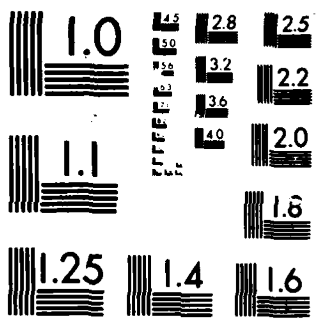
AD-A164 508 PHOSPHOROBACTERIN AND ITS EFFECTIVENESS(U) FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OH Y N MISHUSTIN 30 JAN 86 FTD-ID(RS)T-1432-84

1/1

UNCLASSIFIED F/G 2/1 NL

END
FILMED
DTIC


1.0
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6

FTD-ID(RS)T-1432-84

FOREIGN TECHNOLOGY DIVISION

AD-A164 508

"PHOSPHOROBACTERIN" AND ITS EFFECTIVENESS

by

Ye. N. Mishustin

86 2 18 065

FTD-ID(RS)T-1432-84

UNEDITED MACHINE TRANSLATION

FTD-ID(RS)T-1432-84 30 Jan 86

MICROFICHE NR: FTD-86-C-001431

"PHOSPHOROBACTERIN" AND ITS EFFECTIVENESS

By: Ye. N. Mishustin

English pages: 57

Source: Izvestiya Timiryazevskoy Sleskokhozyaystvennoy Akademii, Nr. 4, 1967, pp. 65-83

Country of origin: USSR
This document is a machine translation.
Requester: FTD/TQTR
Approved for public release; distribution unlimited.

Accession For
NTIS GRA&I ☒
DTIC TAB ☐
Unannounced ☐
Justification

By
Distribution/
Availability Codes
Dist | Avail and/or Special
A-1

THIS TRANSLATION IS A RENDITION OF THE ORIGINAL FOREIGN TEXT WITHOUT ANY ANALYTICAL OR EDITORIAL COMMENT. STATEMENTS OR THEORIES ADVOCATED OR IMPLIED ARE THOSE OF THE SOURCE AND DO NOT NECESSARILY REFLECT THE POSITION OR OPINION OF THE FOREIGN TECHNOLOGY DIVISION.	PREPARED BY: TRANSLATION DIVISION FOREIGN TECHNOLOGY DIVISION WP-AFB, OHIO.

U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

GRAPHICS DISCLAIMER

All figures, graphics, tables, equations, etc. merged into this translation were extracted from the best quality copy available.

Page 65.

"PHOSPHOROBACTERIN" AND ITS EFFECTIVENESS.

Ye. N. Mishustin (department of microbiology).

Under field conditions phosphorobacterin, i. e. the preparation containing Bac. megaterium, slightly increases the yield of farm crops. According to the data of experimental institutions, the average increase in yield is about 10%.

The available data show that phosphorobacterin is more effective on the soils where phosphoroacid fertilizers were applied. This gives rise to doubt as to the thesis that phosphorobacterin mainly improves phosphorous nutrition of plants.

One may also consider it proved that Bac. megaterium has not any artive propagation on the root surface and in the rhisosphere of plants. This fact makes one give up the theory of R. A. Menkina, the author of phosphorobacterin, about the nature of the relationship between higher plants and Bac. megaterium.

The available data make one believe that the effect of phosphorobacterin is due to the presence in Bac. megaterium culture of a number of biologically active substances stimulating the first stages of the development of bacterial plants.

As a result of works, carried out in institute of agricultural microbiology of VASKhNIL [ВАСХНИЛ - All-Union Academy of Agricultural Sciences im. V. I. Lenin], R. A. Menkina even before Great Patriotic War proposed as bacterial fertilizing preparation "phosphorobacterin", which contains culture of spore-forming bacterium Bac. megaterium. This microorganism is capable to destroy organophosphorus compounds and to convert them into the form accessible to plants.

Reserve of organic compounds of phosphorus in soils, especially rich in humus, is sufficiently to large ones. Frequently it comprises more than 50% total content of phosphorus in the soil. It is thought, that phosphorobacterin contributes to mineralization of this fund and to increase in the productivity.

Phosphorobacterin will be brought in to sown seeds. In the opinion of R. A. Menkina, the bacteria containing in it change in the soil from the seeds to the developing root system of plants. Here their reproduction/multiplication and biochemical activity provide the decomposition of the organic compounds of phosphorus that the nourishment of plants improves. Considerably later L. M. Dorosinskiy [9], analyzing the effect of phosphorobacterin on plants, confirmed this its theoretical base of action of this preparation.

Recently it was explained that Bac. megaterium produces different genus biologically active materials. Therefore is not eliminated their favorable effect/action on the plant and the microbiological processes in the soil.

In the USSR phosphorobacterin is prepared in considerably greater quantities than other bacterial fertilizers. In 1966 about 9 million hectare portions of this preparation were released. In our opinion, this is determined mainly by simplicity of the production of phosphorobacterin, but not by the demand for it of agriculture.

Effectiveness of phosphorobacterin frequently causes discussion; therefore more than it is expedient to total results, obtained during its use/application, and to analyze contemporary state of theory of action of this preparation on plant. We consider useful to, first of all, to examine the effectiveness of "phosphorobacterin", which is recommended to use for all agricultural cultures. Data of experimental institutions are most reliable in this respect; therefore should be in greater detail dismantled/selected precisely they.

Page 66.

I. I. Samoilov [59], who summed up results of experiments/experiences, carried out by phosphorobacterin by different investigation institutions of USSR, arrived at conclusion that this preparation raises productivity of agricultural crops in 66-100% of cases. Considerably later in the summary of L. M. Dorosinskiy [9] it is indicated that "phosphorobacterin" gives positive results in 84% of cases. The experimental geographical network/grid, which tested/experienced this preparation in 1958-1960, obtained modest results: of 56 experiments only into 20 (36%) was obtained the reliable addition of crop. The All-Union institute of oleaginous and essential oil cultures for the years 1952-1955 ran on the Ciscaucasian lixiviated black soil 27 tests, in which was studied the effect/action of phosphorobacterin on the different agricultural cultures. Only in 9 experiments (33%) reliable positive result [12] was established/installed. We count the data of two latter/last institutions by more objective, since these institutions are not connected with the production of phosphorobacterin and will fulfill only control functions.

For judgment about value of addition of crop obtained from phosphorobacterin let us examine summary of materials of mass experiences of investigation institutions of USSR, made R. A. Menkina [38] (Table 1). From the different agricultural cultures it was carried out from 6 to 60 experiments. In the chernozem and non-chernozem (sod-podzolic) zones phosphorobacterin gave the small addition of crop, which approaches a possible error of field experiment/experience.

Sample, made by us from the previous work of R. A. Menkina [35], make it possible to speak about higher effectiveness of phosphorobacterin: on sod-podzolic soils this preparation increases crop of agricultural crops on the average by 25.1%, and on chernozem ones - 22.7%.

I. I. Samoilov with co-authors [58] summed up materials of 157 experiments with phosphorobacterin, set by 63 research institutions (Table 2). As is evident, the average/mean addition of crop from phosphorobacterin was equal to 9.8%, i.e., approached the indicators, given by R. A. Menkina in the work of 1958 [38].

Table 1. Average/mean addition of the crop of agricultural crops from phosphorobacterin according to the data of the experimental institutions of the USSR for the years 1952-1955.

(1) Культура	(2) Черноземная зона			(3) Нечерноземная зона		
	(4) контроль, ц/га	(5) средняя прибавка от фосфоробактерина		(4) контроль, ц/га	(5) средняя прибавка от фосфоробактерина	
		(6) ц/га	%		(6) ц/га	%
Озимая пшеница (7)	22,8	1,8	7.9	23.1	0,4	1.7
Озимая рожь (8)	22,8	1,9	8.3	15.4	1,7	11.0
Яровая пшеница (9)	15,0	1.2	8.0	9.0	0,6	6,6
Ячмень (10)	23,2	1,4	6.2	15.9	2.9	18.2
Овес (11)	19,5	2.1	10,5	13.0	1,7	13.0
Просо (12)	21.4	1,5	7.1			
Кукуруза (зерно) (13)	37,8	2,6	6,9			
Картофель (14)	153,7	18.0	11.4	188,1	12,8	6,9
Средняя прибавка по всем культурам (15)	—	—	8.3	—	—	9,6

Note. Table gives only the experiments/experiences, which gave they are positive; the result.

Key: (1). Culture. (2). Chernozem zone. (3). Non-chernozem region. (4). control, c/ha. (5). average/mean addition from phosphorobacterin. (6). c/ha. (7). Winter wheat. (8). Winter rye. (9). Spring wheat. (10). Barley. (11). ~~Bes~~ Oak (12). Vine mesquite. (13). Maize (grain). (14). Potatoes. (15). Average/mean addition on all cultures.

Page 67.

In summary of materials on effect/action of phosphorobacterin, published by I. I. Samoilov later [60], are given somewhat higher indicators: on it is chernozem; to zone - 14%, and on non-chernozem -

11%. However, on the whole the presentation/concept about the low-result of this preparation from this little is changed.

In experiences of E. V. Pudova [57] with flax on sod-podzolic soils on the average in 6 years crop of fiber from use/application of phosphorobacterin increased by 6.9%, and crop of seeds - to 7.7%. Much the same was the effectiveness of phosphorobacterin in the experiments/experiences, set up at Tomsk and Pskov experimental stations. The addition of the crop of fiber oscillated in limits of 7.2-9.2%. The information about the positive effect/action of phosphorobacterin on the sugar beet is contained in the work of I. A. Heller and Ye. G. Khariston [7].

For illustration of effect/action of phosphorobacterin it is possible to give also results of experiments/experiences of Yu. K. Kudzin [22] (Tables 3 and 4), from which it is evident that on the black soils the preparation gives not so high an effect; the average/mean addition of crop approaches 6-8%.

From experiences of Yu. K. Kudzin with coworkers [23, 25, 26] it follows that different cultures Bac. megaterium essentially are distinguished by its effect/action on the high plant. Analogous information exist in the work of M. K. Kvaratskheli [16].

According to data of T. M. Andronova [2], who conducted experiments/experiences in Omsk region (Siberian institute of agriculture), average/mean addition of crop from phosphorobacterin is equal to 8%.

S. A. Samtsevich (see Kudzin [24]) from use/application of phosphorobacterin under maize on chernozem soils obtained average/mean addition of crop of foliage 10% (Table. 5).

A. G. Novikov [47, 49] treated data of approximately 340 experiences/tests of scientific research institutions of USSR, set in 1952-1961. The average/mean additions of crop were following (%): winter wheat - 10; spring - 13; maize (grain) - 9; potatoes - 9.5. In the non-chernozem region the effect from phosphorobacterin was not lower than in the chernozem.

In personal experiences of A. G. Novikova large additions to crop gave phosphorobacterin on black soils of Kustanay region under favorable conditions. However, crop in these experiments was considered by the method of meter areas/sites; therefore were possible the high results. The author notes that the effectiveness of phosphorobacterin to a certain degree depends on agricultural engineering and especially on the method of processing the soil.

Table 2. Average/mean addition of the crop of basic agricultural cultures from phosphorobacterin.

Культуры	Число опытов	Урожай в контроле, ц/га	Прибавка от фосфоробактерина	
			ц/га	
Яровая пшеница	22	13,8	1.0	7.2
Просо	24	15.6	1.4	7.0
Озимая пшеница	10	20,7	2.4	11.5
Ячмень	4	17.9	1.5	8.3
Овес	4	12.3	0,9	7.3
Гречиха	6	13.2	1.4	10,8
Картофель	11	156,0	26.1	16,6
Средняя прибавка по всем культурам	—	—	—	9.8

Key: (1). Cultures. (2). Number of experiments/experiences. (3). Crop in control, c/ha. (4). Addition from phosphorobacterin. (5). c/ha. (6). Spring wheat. (7). Vine mesquite. (8). Winter wheat. (9). Barley. (10). Oats. (11). Buckwheat. (12). Potatoes. (13). Average/mean addition on all cultures.

Table 3. Effect of phosphorobacterin on the crop of winter wheat (data of Erastov experimental station).

1 Годы	2 Урожай, ц/га		5 Прибавка от фосфоробактерина, ц/га
	3 контроль	4 с фосфоробактерином	
1952	25.1±0,27	28.4±0.42	3.3
1953	30,3±0,29	32.2±0.02	1,9
1954	9.0±0,36	9,7±0,02	0,7
1955	25,8±0,40	27.0±0,30	1,3
1957	23,4±0,16	25.0±0,21	1.6
6 Среднее за 5 лет	22,7	24,5	1,8 (7.9%)

Note. 1954 it was arid.

Key: (1). Years. (2). Crop, c/ha. (3). control. (4). with phosphorobacterin. (5). Addition from phosphorobacterin, c/ha. (6). Average in 5 years.

Page 68.

According to data of M. P. Zhrenta [14], productivity of wheat from phosphorobacterin on black soils of Caucasus was raised by 11-30%. K. G. Mazepin [30] on lixiviated black soil obtained from phosphorobacterin addition of crop of sugar beet to 2.3-6%.

In 1965 L. M. Dorosinskiy [9] published results of testing of phosphorobacterin in different investigation institutions of USSR, which placed in 1962 of 24 field experiments/experiences.

Average/mean increase in the productivity of the agricultural crops equalled 9% (Table 6).

M.G. Kvaratskheliy [16] presents the results of testing of a number of crops Bac. megaterium with the cultivation of maize and wheat on the usual black soil.

Table 4. Effect of phosphorobacterin on the crop of grain of maize (average data in 3-5 years).

1 Опытные станции	2 Урожай, ц/га		3 Прибавка от фосфоробактерина		7 Колебания прибавок за разные годы, ц/га
	4 контроль	5 с фосфоробактерином	6 ц/га	%	
Эрастовская 8	27,6	30,0	2,4	8,0	0,4—4,2
Красноградская 9	19,2	20,8	1,6	7,7	0,4—2,5
Розовская 10	25,9	27,5	1,6	5,9	1,0—2,2
Измаильская 11	33,3	34,0	0,7	2,1	0,2—1,8
Ставропольская 12	37,2	39,5	2,3	5,9	0,6—3,6
Опытное хозяйство Института кукурузы 13	24,2	26,6	2,4	9,0	1,7—3,5
Средняя прибавка урожая 14	—	—	—	6,4	0,2—4,2

Note. Experimental institutions relate to the system of the scientific research institute of maize.

Key: (1). Experimental stations. (2). Crop, c/ha. (3). Addition from phosphorobacterin. (4). control. (5). with phosphorobacterin. (6). c/ha. (7). Oscillations/vibrations of additions for different years, c/ha. (8). Erastov. (9). Krasnograd. (10). Rozov. (11). Izmail. (12). Stavropol. (13). Experimental economy of institute of maize. (14). Average/mean addition of crop.

Table 5. Increase in the crops of the foliage of maize from the use/application of phosphorobacterin (average results of mass experiments/experiences).

Области 1	2 Урожай, ц/га		3 Прибавка от фосфоробактерина	
	4 контроль	5 с фосфоробактерином	6 ц/га	%
Киевская 7	359,7	390,5	30,8	7,6
Сумская 8	349,8	399,7	40,9	10,3
Львовская 9	330,0	390,0	50,0	15,4
Херсонская 10	164,3	177,0	12,7	7,2
Среднее увеличение урожая 11	—	—	—	10.1

Key: (1). Regions. (2). Crop, c/ha. (3). Addition from phosphorobacterin. (4). Control. (5). with phosphorobacterin. (6). c/ha. (7). Kiev. (8). Sumy. (9). L'vov. (10). Kherson. (11). Average/mean increase in crop.

Table 6. Increase in the productivity of agricultural crops from phosphorobacterin.

Культуры (1)	(2) Средний урожай в контроле, ц/га	(3) Прибавка от фосфоробактерина, %
Пшеница: (4)		
озимая (5)	40,6	3,9
яровая (6)	20,1	9,5
Кукуруза: (7)		
зеленая масса (8)	149,4	5,7
початки (9)	58,2	6,2
зерно (10)	32,5	14,0
Картофель (11)	174,5	15,3
Среднее (12)	—	9,1

Key: (1). Cultures. (2). Average/mean crop in control, c/ha. (3). Addition from phosphorobacterin, %. (4). Wheat. (5). winter crop. (6). spring. (7). Maize. (8). foliage. (9). beginnings. (10). grain. (11). Potatoes. (12). Average.

Page 69.

The average/mean addition of the crop of maize was equal to 5.9%, and winter wheat - 7%. The crop of grain of maize in the control was equal to 32.7 c/ha, and winter wheat 31-35 c/ha. On the chernozem soils of Siberia in the experiences of V. I. Krasnov [19] addition of the crop of the vine mesquite from phosphorobacterin composed 11.2%.

In different places for USSR, mainly on turf podzolic and chernozem soils of European USSR, we set about 50 experiments with phosphorobacterin [44]. The average/mean addition of the crop of cereal crops was equal to 5.8%, and vegetable - 11.9%. Part of the experiments was carried out in peat-humus small cube-shaped particles, prepared according to V. I. Edel'shteyn's method [72].

According to P. P. Samoilov [59], vegetable crops more strongly answer to phosphorobacterin than grains. A. F. Makarevskiy [31] obtained, however, from phosphorobacterin the addition of the crop of melon plants not higher than 13%.

According to N. A. Sharova [65], phosphorobacterin favorably influences decorative plants, improving their development and flowering.

On the whole the impression is created that phosphorobacterin gives known stimulation effect, whose degree increases/grows with increase in dose of preparation [58, 73 and others]. However, only small addition of the crop of agricultural plants usually from phosphorobacterin is obtained.

According to Yu. K. Kudzin and I. V. Yaroshevich [25, 26], phosphorobacterin give the same effect, as local application (onto drill rows) of small doses of superphosphate - approximately/exemplarily 5-15 kg/ha P_2O_5 M. Ye. Pronin [56] equates the action of phosphorobasterin to 20 kg. per hectore of P_2O_5 in the rows. Some other researchers [29, 36, 58, 69 and others] are adjusted more optimistic: they are inclined to draw together phosphorobacterin on the effectiveness with the average doses of superphosphate. However, the accumulated at the present time large experiment/experience does not make it possible to agree with this. One should recall that on the podsols, the gray forest soils and the black soils dose P_2O_5, equal to 0.45 c/ha, raises the crop of agricultural crops by 23-30%, and the dose of 1.2 c/ha - to 28-56% [63].

Institute of agricultural microbiology of VASKhNIL recommends the using of phosphorobacterin in essence on black soils. R. A. Menkina [39] insists that phosphorobacterin in the zone of sod-podzolic soils positively acts only upon liming and introduction of organic fertilizers. This point of view is substantiated also by the fact that the reserve of organophosphorus compounds in the black soils is more significant than in other soils, in particular sod-podzolic. However, the strictly experimental data about the

#17

weaker effect/action of phosphorobacterin in the zone of podzolic and sod-podzobic soils are not in literature. The sufficiently thorough experiments of L. A. Young [73] in the Kirov region indicate that in the sod-podzobic soils phosphobacterin at the usual dose gives the addition of the crop of different agricultural cultures to 10-15%; the increased doses raise crop to 17-20%. T. M. Andropov [2] also considers that phosphorobacterin can be effective on the sod-podzolic soils. However, it makes stipulation, that this soil must contain not less than 5% humus. Such turf podzolic soils (obviously, peat-enriched or lying on the carbonate rocks), certainly, is not so/such widespread.

For illustration of best effectiveness of phosphorobacterin on black soils L. M. Dorosinskiy [9] cites following data (Table. 7). As to us it is presented, however, from these data it is possible to draw the diametrically opposite conclusion: preparation acts approximately/exemplarily equally on the different soils.

Page 70.

Thus, available material do not make it possible to agree with fact that phosphorobacterin best of anything acts on black soils.

Experiments/experiences with phosphorobacterin under production conditions frequently gave significant effect. This, certainly, it can be explained by the smaller accuracy of setting experiments.

I. I. Samoilov with co-authors [58] generalized results of almost 700 industrial experiments/experiences with phosphorobacterin, carried out in non-chernozem and chernozem region (Table 8).

As is evident, in non-chernozem region phosphorobacterin crop on the average increased by 11.9%. In the chernozem zone the effect was somewhat above. But if we discard not the instilling confidence the data about the barley, then an average/mean increase in the crop of agricultural crops from phosphorobacterin on the black soils will compose 15.4%.

Considerably modest results are obtained in experiments/experiences with phosphorobacterin in the farms of Lithuania [62]. The average/mean after several years crop of barley increased by 6.4%, the crop of potatoes - to 6.7%, and the additions of the crop of other cultures, including gardens, oscillated from 3.3 to 10%. On the fallow low-humus black soils of Omsk region the harvest of spring wheat was increased from phosphorobacterin by 8% [1].

Sometimes in the literature indications of vast additions of crop from use/application of phosphorobacterin are encountered. Thus, according to Ya. N. Ostrovskiy [51], in the kolkhozes of Belorussia this preparation increased the crop of potatoes by 34%, and spring wheat - to 30%. Registration/accounting area in the experiments/experiences was 4-5 ha. Approximately/exemplarily the same results are obtained by V. G. Dudchenko [11] in the experiments/experiences, set up on the lowland peat bogs of Belorussia.

Table 7. Effectiveness of phosphorobacterin on the different soils.

1 Почвы	2 Прибавка урожая от фосфоробактерина, %	
	3 яровая пшеница	4 картофель
5 Дерново-оподзоленные и серые оподзоленные	15	11
6 Черноземы и каштановые почвы европейской части СССР	14	11
7 Черноземы		
Целинного края . . .	16	—
8 Западной Сибири . . .	9	10

Key: (1). Soils. (2). Addition of crop from phosphorobacterin, %. (3). spring wheat. (4). potatoes. (5). Turf-podzolized and gray podzolized. (6). Black soils and chestnut soils of European USSR. (7). Black soils of whole edge. (8). Western Siberia.

Table 8. Effectiveness of phosphorobacterin, according to data of industrial experiments.

1 Культуры	2 Черноземная зона			3 Нечерноземная зона		
	4 урожай в контроле, ц/га	5 средняя прибавка от фосфоробактерина		(4) урожай в контроле, ц/га	(5) средняя прибавка от фосфоробактерина	
		6 ц/га	%		(6) ц/га	%
Просо 7	13,2	1,9	14,4	14,2	1,2	8,4
Пшеница яровая 8	11,8	1,8	15,2	11,7	0,9	7,7
Гречиха 9	8,4	1,6	19,0	8,1	1,6	19,7
Ячмень 10	9,7	3,9	40,2	12,3	1,2	9,7
Овес 11	10,1	1,3	12,8	11,2	1,4	12,5
Кукуруза 12	20,4	2,5	12,7	—	—	—
Картофель 13	103,2	19,4	18,3	13,1	17,5	13,3
Средняя прибавка по всем культурам 14	—	—	18.9	—	—	11.9

Key: (1). Cultures. (2). Chernozem zone. (3). Non-chernozem region. (4). crop in control, c/ha. (5). average/mean addition from phosphorobacterin. (6). c/ha. (7). Vine mesquite. (8). Wheat, spring. (9). Buckwheat. (10). Barley. (11). Oats. (12). Maize. (13). Potatoes. (14). Average/mean addition on all cultures.

Page 71.

In kolkhoz "call of Ilyich", Altai edge, crop of spring wheat from phosphorobacterin was increased by 77% (with collection of grain in control 16.4 c/ha). Registration/accounting area in this case approached 150 GA [27]. While a similar experimentation, certainly, the most unexpected results could be obtained. Preparation in the economies, located in chernozem strip [55], was no less effective.

Crop of vegetable and industrial crops from phosphorobacterin frequently are increased by 30-50% [58, 59, 60, 71].

On the basis of data of A. Ponomareva [54] it is possible to make the conclusion that positive effect/action of phosphorobacterin especially is strengthened, if crops of grains fall to 1-1.5 c/ha. Then bacterization doubles (!!) crop. Certainly, a similar result is so doubtful, that it should be published.

We are inclined to explain information about high effectiveness of phosphorobacterin under production conditions by erroneous experimental setup. In this convince, in particular, the data of L. G. Piskareva [53], who performd an experiment with phosphorobacterin in the collective farm fields and at experimental station. In the first case, when registration/accounting area reached 5 GA, the addition of the crop of potatoes from bacterization composed 41.6%, and vine mesquite 21.4%. In the accurately experiments of experimental station phosphorobacterin presented virtually did not act: the addition of crop was equal to 5.7%. Unfortunately, L. G. Piskareva herself did not properly analyze the results of her work and overestimated the effectiveness of phosphorobacterin.

Effect of cultivated nature of soil and fertilizers on effectiveness of phosphorobacterin is insufficiently explained. Thus, according to Yu. K. Kudzin and I. V. Yaroshevich [22], on the well cultivated black soils phosphorobacterin does not give positive effect. True, in some experiences of Yu. K. Kudzin [21] it is simple, wheat and flax gave on superphosphate greater crop from phosphorobacterin than on unfertilized background. In the experiences of other researchers also on the soils, secured with phosphoric acid and which possess high biological activity, phosphorobacterin did not give noticeable effect of [42].

I. I. Samoilov with co-authors [58] obtained satisfaction contradictory/opposite conclusion. In their opinion, on the fertilized soils phosphorobacterin acts more effectively. True, this assertion relates to a considerable degree to the soils of non-chernozem strip; however, from R. A. Menkina's materials [37] it nevertheless follows that also on the black soil, fertilized by superphosphate, phosphorobacterin acts better than against the background without the mineral fertilizers. Analogous opinion adhere to some other authors [13, 66, 69 and others].

Ineffectiveness of phosphorobacterin to lean in organic compounds phosphorus soils note A. K. Panosyan and R. N. Khodzhayan [52]. Besides the field experiments/experiences, about the best effect/action of phosphorobacterin on the fertilized soils testify vegetative experiments by R. A. Menkina [36] and L. A. Young [73].

One of field experiments/experiences L. A. Young on sod-podzolic soil of Kirovskaya district clearly shows beneficial effect of superphosphate on effectiveness of phosphorobacterin (Table 9).

Other researchers also cite experimental data about need for combination of phosphorobacterin with use/application of superphosphate. Thus, A. G. Novikov [49] arrived at the conclusion that on the old-arable black soils phosphorobacterin it is generally inexpedient to use without superphosphate.

Page 72.

Speaking about conditions of effecting/acting phosphorobacterin, especially should be noted work of S. A. Karagulyan [15]. On the basis of experimental material this researcher asserts that on dark-chestnut soil this preparation should be used only in the complex with organic fertilizer and superphosphate. On the black soils, rich in phosphorus, but which contain little phosphorus (0.06-0.08% P_2O_5), without superphosphate phosphorobacterin does not act. On the richer in humus black soils phosphorobacterin the specific effect gives, but upon the introduction of superphosphate its positive effect/action on the crop is strengthened.

Increase in effectiveness of phosphorobacterin on background of mineral fertilizers note other researchers [4, 75]. Even on the weakly-lixiviated black soil of the wooded plain of Omsk region phosphorobacterin without the fertilizer (humus) effect does not give [5].

Thus, entire accumulated material forces to arrive at somewhat unexpected conclusion. It proves to be that phosphorobacterin does not replace phosphoric fertilizer, as the author of preparation asserts this, but some additional useful effect exerts against the backgrounds, fertilized by phosphate salts. In connection with the aforesaid a question about the value of the productivity of soil background for determining the effectiveness of phosphorobacterin is very important. I. I. Samoilov with co-authors [58] they assert that on more polytocous soils phosphorobacterin acts better. ~~We~~ In Table 10 We have cited corresponding data from their work. They are obtained in the industrial tests and cannot pretend for high accuracy. Nevertheless, if we exclude the available deviations, which carry accidental character/nature, then hardly it is possible to agree with the opinion of I. I. Samoilov. The average value of additions against all backgrounds remains sufficiently constant and oscillate about 10-13%.

Table 9. Effect of phosphorobacterin on the crop of the barley, grown on the differently fertilized sod-podzolic soil.

Варианты опыта (1)	Урожай ячменя, ц/га (2)	Прибавка от фосфоробактерина (3)	
		ц/га (4)	%
Контроль (5)	16,1	—	—
Фосфоробактерин (6)	17,2	1,1	6,9
Порошковидный суперфосфат (60 кг/га) под предпосевное культивирование (7)	17,0	0,9	5,5
То же + фосфоробактерин (8)	18,6	2,5	15,5
Гранулированный суперфосфат (15 кг/га) в рядке (9)	19,2	3,1	19,3
То же + фосфоробактерин (10)	22,1	6,0	37,2

Key: (1). Experimental variants. (2). Crop of barley, c/ha. (3). Addition from phosphorobacterin. (4). c/ha. (5). Control. (6). phosphorobacterin. (7). Powdery superphosphate (60 kg/ha) under presowing cultivation. (8). The same + phosphorobacterin. (9). Granulated superphosphate (15 kg/ha) in row. (10). The same + phosphorobacterin.

Table 10. Addition of the crop of cereal crops (c/ha) from phosphorobacterin depending on the level of agricultural engineering.

Культуры (1)	Черноземная зона (2)				Нечерноземная зона (3)			
	прибавка от фосфоробактерина при урожае в контроле, ц/га (4)							
	8—10	10—15	15—20	20—25	8—10	10—15	15—20	20—25
Просо (5)	1,4	1,7	2,7	2,9	0,8	1,3	1,6	0,9
Пшеница (6)	1,3	2,3	1,8	1,2	0,8	1,0	1,5	2,0
Гречиха (7)	1,1	2,3	1,7	0,8	0,8	2,4	3,2	—
Средняя прибавка: (8)								
ц/га	1,3	2,1	2,1	1,6	0,8	1,6	2,1	1,5
% от среднего урожая (9)	14	17	11	7	9	13	11	9

Key: (1). Cultures. (2). Chernozem zone. (3). Non-chernozem region. (4). addition from phosphorobacterin with crop in control, c/ha. (5). Vine mesquite. (6). Wheat. (7). Buckwheat. (8). Average/mean addition: c/ha. (9). from average/mean crop.

Page 73.

With phosphorobacterin many researchers set vegetative experiments/experiences. They showed that gives greater or smaller addition of the crop of agricultural crops phosphorobacterin, as a rule. Thus, in R. A. Menkina's experiments [36], carried out in 1951, an increase of the crop of plants in the vegetative experiment/experience from Bac. megaterium was from 6 to 42%. On the peat soil phosphorobacterin increased the crop of oats even by 46%. Introduction of superphosphate gave much the same result (51%), and the joint introduction of superphosphate and phosphorobacterin was still more effectively: crop increased by 81%. The large addition of crop on the peat soil Bac. megaterium it gave also in the later experiments/experiences of R. A. Menkina [40]. This microorganism contributed to an increase in the plant mass by 35-55%.

In vegetative experiments/experiences with black soils of Georgia phosphorobacterin and culture Bac. megaterium increased crop of winter wheat by 14.5-27.8% [14]. In other vegetative experiments/experiences [46, 74] with the different agricultural cultures the results were more modestly: the addition of crop composed 7-13%. In the experiences of Ye. K. Dubovenko [10] bacterization gave growth in the crop of barley and wheat to 15-30%. This effect was obtained as from Bac. megaterium they raised the crop of grain by 80-90%. The average/mean addition of the crop of barley in the series of vegetative experiments/experiences in 1959 was equal to 25%, and in 1962 - 66.3%. To the extreme regret, M. G. Kvaratskheliya is not explained, why the same cultures Bac. megaterium, utilized against the very favorable background, namely on the black soils, under the conditions of field experiment/experience gave the very small effect: they increased the crop of grains only by 6-7% (!).

On the whole it is not possible to deny that phosphorobacterin exerts specific stimulation effect to plants. Under the conditions of vegetative experiment/experience this effect appears more strongly, and below we give the possible explanation to this phenomenon. Vast experiment/experience nevertheless shows that under the conditions for field experiment an increase in the productivity into average/mean not more than 10%. In view of the mass character of the experiments/experiences and presence in a significant number of cases of the statistical interpretation of material, which testifies about the authenticity of results, the noted effect can be taken for granted..

Recently series/number of vegetative experiments/experiences with different agricultural cultures was set in our laboratory. They are carried out by V. I. Aristarkhova, R. M. Sergeyeva and I. M. Miropol'skaya. Compound results are given in Table 11. In the series of experiments the addition of crop from bacterization is statistically reliable.

Bac. megaterium against all backgrounds gave certain addition of crop. On the lean light-chestnut unfertilized soil actually there was only zero effect. However, the result, obtained from Bac. megaterium, is not compared with the effect of superphosphate and manure. This is evident from Table 12, in which are given the average data of all vegetative experiments/experiences indicated.

Since in described set of experiments it also seemed that Bac. megaterium somewhat increases productivity, also, against backgrounds, secured not only with phosphorus, but also with other elements/cells of mineral nourishment, it is necessary to think that phosphorobacterin acts somewhat otherwise how they usually consider.

Let us give still data of experiments, carried out in department of microbiology of I. M. Miropol'skaya~~'s microbiology~~ TSKhA with maize, grown on usual black soil of Voronezh region (Table 13).

In this experiment/experience completely were repeated results of previous investigations, namely: against all backgrounds Bac. megaterium it gave addition of crop within limits of 10%, whereas mineral phosphorus increased ~~35~~ 45 to 70%. In other experiments, carried out in the conditions of vegetation booth, identical results are obtained; therefore we do not give them.

Page 74.

Table 11. Comparison of the effect/action of different fertilizers on the crop of agricultural crops under the conditions of vegetative experiment/experience.

Варианты опыта	Светло-каштановая почва		Чернозем Казахстана		Чернозем Каменной степи, зерно пшеницы	
	соевые бобы	кукуруза (зеленая масса)	соевые бобы	кукуруза (зеленая масса)	I опыт	II опыт
Контроль	1,62 / 100,0	14.00 / 100,0	1.30 / 100,0	20.00 / 100.0	2,6 / 100,0	2.2 / 100.0
Bac. megaterium	1,70 / 104,9	14.21 / 101,5	1,40 / 107,7	21.90 / 109.5	2.8 / 107.7	2.9 / 131.8
Суперфосфат	1,95 / 120,4	26.65 / 190,3	2.02 / 155,3	27.90 / 139,5	3,3 / 126,9	3.0 / 136,3
Суперфосфат+Bac. megaterium	2.15 / 126,5	28.65 / 204.6	2.17 / 166,9	30.90 / 154.50	—	—
Навоз	2.60 / 160,5	28.88 / 222,0	2.70 / 207,7	33,55 / 167.8	—	—
Навоз+Bac. megaterium	2,65 / 163,5	35.52 / 232,3	2.94 / 226,1	36.05 / 180.2	—	—

Note: 1. In the numerator - g/vessel; in the denominator - %. 2. Superphosphate was introduced from calculation 1.5 c/ha, manure - 60 t/ha. Control seeds wetted by water, experimental - by culture Bac. megaterium. Tests were conducted in the vessels for 8 kg. of soil.

Key: (1). Experimental variants. (2). Light-chestnut soil. (3). Black soil of Kazakhstan. (4). Black soil of rocky steppe, grain of wheat. (5). soy-bean beans. (6). maize (foliage). (7). experiment/experience. (8). Control. (9). Superphosphate. (10). Manure.

Table 12. Comparison of the effect/action of different fertilizers on the agricultural plants (%).

(1) Удобрения	(2) Относительная величина урожая	(3) Прибавка	
		(4) от фосфоробактерина	(5) от минерального или органического удобрения
Контроль (6)	100.0	—	—
«Фосфоробактерин» (7)	110.5	10.5	—
Суперфосфат (8)	144.8	—	44.8
Суперфосфат+фосфоробактерин (9)	163.1	18.3	—
Навоз (10)	189.5	—	89.5
Навоз+фосфоробактерин (11)	200.5	11.5	—

Key: (1). Fertilizers. (2). Relative value of crop. (3). Addition. (4). from phosphorobacterin. (5). from mineral or organic fertilizer. (6). Control. (7). phosphorobacterin. (8). Superphosphate. (9). Superphosphate + phosphorobacterin. (10). Manure. (11). Manure + phosphorobacterin.

Table 13. Effect of different fertilizers on the crop of the foliage of maize, grown on the black soil of rocky steppe (Voronezh region).

(1) Варианты опыта	(2) Вес сухой массы			
	1964 г.		1965 г.	
	(3) г на сосуд	%	(3) г на сосуд	%
Без удобрений (4)	20.16	100.0	17.45	100.0
Bac. megaterium	21.83	108.2	19.10	109.1
NK	24.39	120.9	21.50	122.8
NK+Bac. megaterium	26.60	131.6	22.70	129.7
NPK	37.96	187.9	34.10	194.9
NPK+Bac. megaterium	38.93	192.5	34.35	196.3

Note. Fertilizers introduced 1.5 norms of Hellriegel from calculation.

Key: (1). Experimental variants. (2). Weight of dry mass. (3). g/vessel. (4). Without fertilizers.

Page 75.

As a whole our inherent work experience with phosphorobacterin speaks, that vegetation method completely confirms results of mass tests of this preparation by experimental institutions of USSR. Phosphorobacterin usually provides small addition of crop. On the soils, lean in organic matter also of the not obtained fertilizers, it proves to be ineffective. The positive effect/action Bac. megaterium against the backgrounds, secured with phosphorus, makes it necessary to think that they are observed; effect is not connected with the destruction by this microbe of organic phosphoric compounds in the soil. This is confirmed by the fact that phosphorobacterin exerts certain positive effect/action also on the soils, which obtained the complete fertilizer.

Should be underscored fact, which can have specific practical value. It seemed that Bac. megaterium stimulates the development of root system to the considerably greater degree, than the above-ground mass of plants. It is possible therefore that phosphorobacterin is expedient to use for an improvement in the increase in the seedlings of fruit plants. Analogous fact was noted by I. I. Samoilov [58], and also by V. I. Shtapkin [67, 68], who experimented with the cuttings of grapes and as a result of applying phosphorobacterin the landing material of considerably best quality was obtained.

After explaining degree of increase in crop of agricultural plants under effect of phosphorobacterin, let us try to analyze character/nature of this action. R. A. Menkina assumes that Bac. megaterium, being multiplied in the zone of root, improves the phosphoric nourishment of plants, stimulates the series/number of microbiological processes, thanks to which in the soil the reserve not only of mobile/motile phosphates, but ammonia and nitrates is increased. The materials given by R. A. Menkina [35, 40, 41], show that as a result of applying phosphorobacterin in the soil the quantity of ammonifiers, nitrifiers, cellulose, butyrate bacteria, etc sometimes into dozens of times increases/grows. Similar data can be met in the work of other researchers. In particular, M. P. Zhgenti [14] showed that as a result of applying phosphorobacterin in the soil a quantity of microorganisms of the series/number of groups sharply is increased.

In critical examination these presentations/concepts are received with difficulty. Business consists, first of all, in the fact that in each soil is a large number of microorganisms, which possess phosphatase [8, 10, 17, 46, 64 and others]. Among the microorganisms, which destroy organic phosphates, are actinomycetes, the fungi and bacteria. Among the latter phosphatase activity possess the representatives of many genera - Bacillus, Bacterium, Pseudomonas, Rhizobium and so forth. The noted groups of microorganisms abundantly populate not only soil, but also rhizosphere and the surface of root.

According to data of our laboratory, up to 5% of microorganisms of soil and rhizosphere can destroy nucleic acid. Among them are always encountered the bacteria, carried to form/species Bac. megaterium. The number of latter as this is shown by our works [45], is determined by cultivation nature of soil. According to our data, in 1 g of the soil of rhizosphere of plants, which grow on the sod-podzolic or chernozem soil, are hundreds of thousands (to several million) of the cells of the bacteria, that decompose/expand nucleic acid. Other researchers [42, 47 and others] give even higher indicators.

Page 76.

To hectare dose of seeds is usually introduced 15 g of phosphorobacterin, which contains about 120 billion cells Bac. megaterium. Generally, if we assume that Bac. megaterium evenly is distributed on the soil, then to each gram of the soil of arable layer it is necessary only on 40 cells of this bacterium. The question arises: is it possible to believe that the introduction of several ten embryos Bac. megaterium in 1 g of soil can cause the radical rearrangement of its biodynamics and activate/promote the multimillion grouping of the microbial population, whose significant part possesses phosphatase. Let us note that, according to the data of Fiedler and Jean-Desbak [80], Bac. megaterium it can destroy only the small part of organic phosphates of soil.

Certainly, R. A. Menkina's developed presentations/concepts cannot be considered substantiated. As it is possible to nevertheless explain the increase of the number of microbes in soil and zone of the root of plants after the use/application of phosphorobacterin, noted in the works of the series/number of researchers [14, 40 and others]. In our opinion, this is the result of noncritical relation to analytical data, obtained moreover, without a sufficient quantity of repetitions. It is widely-known that by virtue of the series/number of reasons during microbiological investigations of microflora of the root of plants and soil the indicators sufficiently strongly oscillate. These deviations with the method of the titer, which R. A. Menkina usually put to use are especially sharp. Therefore to make correct conclusion about the dynamics of microflora is possible being only based on a large number of repetitions or at the frequent sequential analyses. Unfortunately, in the works enumerated above this principle usually was not observed. But rare, separate analyses can lead to the most paradoxical conclusions. Thus, for example, O. V. Yenkina [12] obtained the data, which make it possible for it to speak about the sharp suppression of the ammonifying bacteria as a result of bacterization of soil Bac. megaterium. The basic reason for this conclusion/derivation is the same methodic error, about which we already spoke.

One of the solidest works on study of effect of phosphorobacterin on microflora of soil belongs to A. G. Novikova [47]. As a result of a significant number of observations it arrived at the conclusion that bacterization substantially does not affect the group composition of the microorganisms of soil.

Several years under conditions of vegetative experiment/experience we studied influence of inoculation of seeds of different agricultural plants by culture Bac. megaterium on life of soil and rhizosphere. Experiments/experiences were placed with the chernozem and sod-podzolic soils. Some regular changes as a result of bacterization we could not reveal/detect. The observed deviations are completely explained by accidental reasons. For example Table 14 gives data of one of the experiments/experiences, set up by I. M. Miropol'skaya with the vine mesquite, grown on the usual black soil of Voronezh region. Table gives average data during the vegetative period.

Table 14. Effect of bacterization on the number of microorganisms of the zone of the root of vine mesquite and soil (account on mercaptopropylamines, thousand in 1 g).

(1) Удобрения	(2) Варианты опыта	(3) Период кущения			(4) Период цветения		
		(5) корни	(6) ризосфера	(7) почва	(5) корни	(6) ризосфера	(7) почва
Без удобрений (8)	(10) Контроль	5420	9200	4230	16050	5800	3130
	(11) Бактеризация	13400	6500	3290	14070	5900	5370
NK	(10) Контроль	19220	40800	16740	24860	12300	5560
	(11) Бактеризация	18100	35500	15730	22320	14600	2590
Навоз (9)	(10) Контроль	22740	87400	22060	32400	70400	27030
	(11) Бактеризация	29810	69900	22500	30500	68200	25670

Note. The mineral fertilizers introduced 1.5 norms of Hellriegel from calculation; manure - from calculation 60 t/ha. A number of bacteria, taken into consideration on the root, is re-read on 1 g of its dry mass; numbers of bacteria of rhizosphere and soil are calculated on 1 g of the corresponding dry soil.

Key: (1). Fertilizers. (2). Experimental variants. (3). Period of bushing out. (4). Period of flowering. (5). roots. (6). rhizosphere. (7). soil. (8). Without fertilizers. (9). Manure. (10). Check. (11). Bacterization.

Page 77.

On the basis of materials Table 14 it is difficult to speak about stimulating effect Bac. megaterium and about increase in total number of saprophytic microflora as a result of bacterization. Deviations in the direction of increase and reduction carry accidental character/nature. It cannot be not at the same time noted that the introduction of the mineral fertilizers (NK) and the manure sharply increased the general/common/total biogenicity of soil. The reason for this is completely clear. Nevertheless can arise a question about intensive propagation of Bac. megaterium in the zone of the root of plants as a result of bacterization. Detailed experimental material does not make it possible to here support the point of view of A. R. Menkina.

On surface of root and in rhizosphere are multiplied almost exceptionally/exclusively nonsporeforming bacteria [18 and others]. Here bacillary population numerically sharply decreases in comparison with its quantity in the soil. According to the data of N. M. Mal'tseva [32, 34], a number of cells Bac. megaterium in different investigated by it soils composed 1.2-19.3% of a number of the bacteria considered, and in the radical zone it descended to 0-0.09%. Using the lasting materials of O. V. Yenkina [12], on the Ciscaucasian lixiviated black soils bacterization did not change the number of cells of Bac. megaterium not only noticeably were not multiplied, but using the available material, even gradually they perished.

In our laboratory A. N. Naumov [46] ran test with mono-bacterial cultures of wheat. Even in the absence of competitors Bac. megaterium var. phosphaticum it was multiplied in the zone of root very weakly. In 1 g of the roots of 10-day-old sprouts of wheat it was to 95 million cells Pseudomonas, and the number of cells Bac. megaterium reached only 0.3 millions. In the nonsterile soil abundant microflora of the zone of root, certainly, reproduction/multiplication Bac. megaterium strongly suppresses.

Use/application of phosphorobacterin, as is shown our sufficiently significant experiment/experience, does not strengthen reproduction/multiplication Bac. megaterium in zone of root and soil. For the illustration let us give one of the experiments, in which were taken into consideration cells Bac. megaterium both the decomposing/expanding and not decomposing/expanding organic phosphoric compounds (Table 15). The total number of saprophytic bacteria in this experiment/experience is indicated in Table 14. Vine mesquite was experimental plant.

As is evident, absolute number of cells Bac. megaterium on surface of root is negligible. Considerably better this bacterium is multiplied in rhizosphere and soil. Positive effect on Bac. megaterium introduction of the mineral fertilizers and manure sharply is developed, but bacterization noticeable effect does not give.

Table 15. Effect of bacterization on development of Bac. megaterium in rhizosphere of vine mesquite and in the soil (thousand in 1 g).

(1) Удобрения	(2) Варианты опыта	(3) Кущение			(4) Цветение		
		(5) корни	(6) ризосфера	(7) почва	(5) корни	(6) ризосфера	(7) почва
Без удобрений (8)	Контроль (10)	1	197	37	1	120	41
	Фосфоробактерин (11)	6	187	40	1	135	37
NK	Контроль (10)	1	419	97	1	310	68
	Фосфоробактерин (11)	7	400	113	1	280	38
Навоз (9)	Контроль (10)	1	613	205	1	400	370
	Фосфоробактерин (11)	1	607	200	1	460	250

Note. Experimental conditions are indicated in the note to Tables 14. Average/mean indicators during the vegetative period are here given.

Key: (1). Fertilizers. (2). Experimental variants. (3). Bushing out. (4). Flowering. (5). roots. (6). rhizosphere. (7). soil. (8). Without fertilizers. (9). Manure. (10). Control. (11). phosphorobacterin.

Page 78.

Made recounts show that number of cells of all forms Bac. megaterium with respect to number of bacteria, taken into consideration on meat-peptone agar, comprises: on surface of root - 0.004-0.02%, in rhizosphere - 0.7-2.8%, in soil - 0.6-1.5%.

It is very essential to explain, what quantity of cells Bac. megaterium from number of those taken into consideration can decompose/expand organophosphorus compounds (nucleic acid) and is how their position among another microflora, which fulfills this function. Average numerals make it possible to conclude that approximately/exemplarily 5-10% of all cells Bac. megaterium can decompose/expand nucleic acid. Bacterization to any extent noticeably does not change this indicator. However, on the whole Bac. megaterium var. phosphaticum in a negligibly small number is located on the root. However, in rhizosphere it comprises not more than 0.1%-1.0% number of microorganisms, which destroy organophosphorus compounds. Again arises the question: is it possible to believe so that this minimum grouping does play the so/such decisive role in the life of plants and productivity? Response/answer, naturally, asserts itself negative.

Thus, entire presented convincingly attests to the fact that known positive effect/action of phosphorobacterin it is not possible to explain by reproduction/multiplication in zone of root and in soil of culture Bac. megaterium introduced there. ~~But~~ Then how can ~~then~~ Bac. megaterium act on the development of the bacterized plant? A similar stimulation effect is confirmed by the series/number of experiments with the sprouts of the plants, carried out in our laboratory. Thus, for example, I. M. Miropol'skaya [43] inoculated the seeds of barley by the different cultures Bac. megaterium, and control rooms in the water. Bacterization beneficially influenced an increase in the young plants (Table. 16). Steeping of seeds of barley in more concentrated suspension of bacteria in this case gave best result, than steeping in more dilute suspension of bacteria.

Analogous result is obtained also in experiments/experiences with other plants.

Culture Bac. megaterium produces series/number of biologically active materials [6, 33, 46, 74 and others]. Among them there are thiamine, pyridoxine, biotin, pantoic and nicotinic acids, vitamin B_{12} and, obviously, other compounds. It is undoubted, that, falling on the surface of seed, and then in its tissue, they beneficially act on the first stages of development and increase in the plants. As the final result this somewhat increases crop. In this case there is a full/total/complete analogy with processing of seeds by vitamins, which also exerts a good effect on an increase in the plants and crop [50].

Table 16. Effect of the inoculation of seeds by culture Bac. megaterium on an increase in the barley (height of 8-day-old plants).

(1) Варианты опыта	(2) Густая суспензия		(3) Разведенная суспензия	
	(4) высота растения, см	(5) увеличение длины, %	(4) высота растения, см	(5) увеличение длины, %
Контроль (6)	10,5	—	10,5	—
Обработка Bac. megaterium: (7)				
штамм 49	16,7	59,0	11,2	7,6
производственная культура (8)	15,7	49,5	12,2	16,0

Key: (1). Experimental variants. (2). Thick suspension. (3). Dilute suspension. (4). height of plant, cm. (5). increase in length, %. (6). Control. (7). Processing/treatment Bac. megaterium strain 49. (8). production efficiency.

Page 79.

Effect of bacterization other researchers relate with effect/action of growth factors [18, 61 and others]. By E. K. Dubovenko [10] were treated the seeds of agricultural plants as Bac. megaterium, so by other microorganisms. The stimulation of increase/growth was revealed, many cultures giving result not worse than Bac. megaterium.

Thus, useful effect of phosphorobacterin we are inclined to explain by primary stimulation effect, which even without reproduction/multiplication Bac. megaterium, since this determines concentration of growth factors.

If we accept our point of view, then it becomes clear, why phosphorobacterin improves not only phosphoric, but also nitric nourishment of plants. Obviously, generally somewhat is strengthened the carrying out/removal of all feeding elements/cells in view of the best increase in the plants. In this respect the data of A. G. Novikova [47], who analyzed the content of nitrogen and phosphorus in the ascents of wheat, processed and not processed with phosphorobacterin (Table 17), are very exponential.

General/common/total content of these elements/cells in plants was not changed, however, since bacterized sprouts were developed more rapidly, carrying out/removal of elements/cells indicated was increased. Certainly, if other elements/cells were analyzed, then picture would be obtained identical, and with the wish it would be possible to assert that phosphorobacterin improves the nourishment of plants by potassium, by microelements, etc.

Generally, if in experiments/experiences effect/action of phosphorobacterin was compared with effect/action not of phosphorus, but any other element/cell, then with surface approach full/total/complete identity here also could be discovered. So, until now, it was done, when phosphorobacterin was compared with the phosphoric fertilizers.

Data of A. G. Novikova contradict materials of I. S. Kudashev [20], in evidence of which phosphorobacterin, as superphosphate, increases the content of nitrogen (protein) in the grain of agricultural plants. This information relative to the effect of "phosphorobacterin" is received with known alertness, since per annum of conducting field experiment very arid weather stood. On all literary information, with the deficiency of moisture phosphorobacterin does not act positively on an increase in the plant. However, in the experience of I. S. Kudashev it not only conditioned the addition of crop, but also contributed to an improvement in his quality.

Setting forth our point of view to mechanism of effect/action of phosphorobacterin, we consider everything already necessary to indicate that series/number of researchers cites data about increase in soil after use/application of phosphorobacterin of reserves of mobile/motile phosphorus and nitrogen. The increase of easily accessible phosphoric acid, accord.ng to these data, with the recount on 1 GA reaches 30-150 kg. (P_2O_5). Analogous information is given also about the mineralization of nitrogen [27, 28, 35, 40 and others].

Table 17. Effect of processing/treatment of the seeds of wheat with phosphorobacterin on the carrying out/removal of nitrogen and phosphorus (area of account 0.25 m²).

(1) Варианты опыта	(2) Сухой вес	N		P_2O_5	
		(3) содержание в растении, %	(4) вынос, мг	(3) содержание в растении, %	(5) вынос, мг
Контроль . . . . . (5)	3,32—3,44	3,77—3,89	12,9—18,5	0,69—0,88	2,92—3,45
Обработка фосфоробактерином . . (6)	5,00—5,69	3,62—3,77	21,2—23,9	0,70—0,84	3,45—5,48

Note. Table shows the limits of oscillations from the series of observations, carried out on the differently processed plots.

Key: (1). Experimental variants. (2). empty weight. (3). content in plant, %. (4). carrying out/removal, mg. (5). Control. (6). Processing/treatment with phosphorobacterin.

Page 80.

Results of testing experiments/experiences, set up by us, do not make it possible to connect to opinion of researchers indicated. The available deviations in the experimental variants did not exceed the possible errors of experiment.

Question arises, as one should relate to communications/reports that phosphorobacterin decreases diseases of agricultural plants, caused by fungi. It is indicated, for example that the use/application of this preparation raises the resistance of gramineous plants to Helmintosporium sativum, sunflower against Sclerotinia libertiana, vine mesquite against Sphacelotheca panici miliacei and so forth. [41]. At the same time is not brought any specific information about antagonistic properties Bac. megaterium var. phosphaticum against the fungus organisms. The antagonistic properties Bac. megaterium are generally badly/poorly studied, but it is known that some cultures of this microorganism produce the antibacterial antibiotic Megacin [79].

Is not eliminated possibility of fact that bacterization, reinforcing plant, can increase its resistance to different genus to causative agents of diseases/illnesses.

In experiences of M. A. Bystrova [3] phosphorobacterin did not prevent disease of winter wheat by brown rust.

On questions of equipment and mechanization of use/application of phosphorobacterin we will not be delayed [48 and others].

According to information available to us, experiments/experiences with phosphorobacterin aligned themselves of foreign institutions. In essence they gave negative result, and the majority of them was not published, with exception of some. Their short selection/analysis we will give below. However, on the whole on the basis of obtained experimental data to phosphorobacterin the relation was formed more negatively, and in practice nowhere it finds use/application.

From published materials we, first of all, will be delayed on work of Smith with co-authors [82]. They twice set vegetative experiments/experiences with phosphorobacterin on 6 different neutral soils (among other things of chernozem ones) with the tomatoes and the wheat. In one of the sets of experiments were placed against the different backgrounds of phosphoric fertilizer and manure. In one case the addition of the crop of tomatoes to 7.5% was only obtained. In the remaining series Bac. megaterium is exerted positive effect neither on the tomatoes nor on the wheat.

They did not obtain positive result in conditions of vegetative experiment/experience from utilization of phosphorobacterin on chernozem-like soil Fiedler and Jean-Disbak [80]. Actually negative result was obtained also in the field experiment/experience. The maize, processed by phosphorobacterin, gave somewhat lower crop than the control, and small addition of the crop of beet it lay/rested within the limits of error.

Significant experimental work with phosphorobacterin conducted Negrean and his co-authors [81]. The addition of the crop of the series/number of agricultural crops was from 11 to 14%. This approaches the results, obtained in the USSR.

Some researchers tried to establish/install effect Bac. megaterium, introduced into the soil, for the mobilization of phosphorus [77, 80, 83 and others]. Partially experiments/experiences were conducted with the utilization of compounds of radioactive phosphorus. The obtained results can be considered negative. Mobile/motile phosphorus was not accumulated or the increase, which lies within the limits of error, was observed. It is not established also the mobilization of nitrogen [80].

Discussing problem of utilization of phosphorobacterin, Smith with co-authors [83] they voice perplexity apropos of theory of R. A.

Menkina. By them it remains incomprehensible, why introduction into the soil of small quantities of commonplace microbe can produce whole revolution in the soil biodynamics. They, as Cooper [78], who was becoming acquainted in the USSR with the use/application of phosphorobacterin, they are inclined to consider that the high estimation of this preparation by some authors is based on the methodically erroneously carried out work.

Page 81.

Conclusions.

1. Generalization of literature data and of its own experimental material shows that use/application of phosphorobacterin in zone of sod-podzolic and chernozem soils in presence of specified conditions can give certain addition of crop.

If we compare effect, obtained from phosphorobacterin, with effect/action of average doses of phosphoric fertilizers, then should be made conclusion about not compared higher result of latter.

2. Effectiveness of phosphorobacterin is retained, and in many instances even it is increased during its utilization on soils, fertilized by other (and also phosphate) fertilizers. This provides a stimulus to take position in the doubt, that the basic effect/action of phosphorobacterin is reduced to an improvement in the phosphoric nourishment of plants.

Accumulated data testify that in plants, processed with phosphorobacterin, appears stimulation effect; such plants more energetically/energy are developed and respectively more greatly they assimilate nitrogen, phosphorus and, obviously, other elements/cells.

3. Bac. megaterium is not propagated to any extent actively on surface of root and in rhizosphere of plants. This fact, just as that presented above, makes it necessary to reject the view of the author of phosphorobacterin R. A. Menkina about the essence of the interrelations of the highest plants and Bac. megaterium, and also about the mechanism of the effect/action of phosphorobacterin.

4. Beneficial effect/action of phosphorobacterin is connected with presence in culture Bac. megaterium series/number of biologically active materials, predominantly vitamins. This effect especially sharply appears during the first phases of the development of plants, which connected with the effect/action of biologically active materials on the germinating seed depends on the denseness of the bacterial suspension plotted/applied to the seed.

Frequently observed stronger effect Bac. megaterium on plant under conditions of vegetative experiment/experience, than in field experiment, it can be explained by fact that in first case to seeds they will bring in more than microorganisms, which contain biologically active materials.

5. Phosphorobacterin cannot be used in agriculture as analog of phosphoric fertilizers. It can be applied as the preparation, which possesses the known stimulation effect. The cases of its worthwhile utilization must be refined.

Pages 82-83.

REFERENCES.

1. Андронова Т. М. Советское [illegible] Сибири, № 7, 1957. — 2. Антропова Т. М. Эффективность фосфоробактерина на почвах Омской области. Автореф. канд. дисс. Омск, 1960. — 3. Быстрова М. А. Тр. Всес. ин-та защиты растений, вып. 13, 1958. — 4. Волчкова З. Ф. Удобрение и урожай, № 7, 1956. — 5. Гамзикова О. И. Действие удобрений на микробиологические процессы в почве, рост и урожайность кукурузы. Автореф. канд. дисс. Томск, 1966. — 6. Гебгард А. Г., Курчук Е. Ф. Сб. «Мікробіологія для народного господарства і медицины». Наукова думка, Киев, 1966. — 7. Гельцер И. А., Харитон Е. Г. «Мікробіолог. журнал», № 5(3), Киев, 1953. — 8. Гурфель Д. Б. Сб. «Микроорганизмы и эффективное плодородие почвы» Тр. Ин-та микробиол. АН СССР, вып. 11, 1962. — 9. Доросинский Л. М. Бактериальные удобрения — дополнительное средство повышения урожая. М., 1965. — 10. Дубовенко Е. К. Микроорганизмы почвы, минерализующие органофосфаты, и их роль в корневом питании растений. Автореф. канд. дисс. Киев, 1962. — 11. Дудченко В. Г. Сб. «Мікробіологія для народного господарства і медицины». Наукова думка. Киев, 1966. — 12. Еникина О. В. Вестник с.-х. науки, № 6, 1962. — 13. Ефимцев М. И. Научн. тр. Луганского с.-х. ин-та, вып. 7, 1960. — 14. Жгенти М. П. Влияние фосфоробактерина на микрофлору почвы и урожайность озимой пшеницы. Автореф. канд. дисс. Тбилиси, 1964. — 15. Карагулян С. А. Эффективность и условия применения фосфоробактерина под зерновые культуры в горных районах Армянской ССР. Автореф. канд. дисс. Ереван, 1955. — 16. Кварацхелия М. Г. Сб. «Использование микроорганизмов для повышения урожайности с.-х. культур». М., 1966. — 17. Котелев В. В., Мехтиев Е. А., Смирнов В. И. Изв. АН СССР, сер. биол., вып. 7, 1962. — 18. Красильников Н. А. Микроорганизмы почвы и высшие растения. Изд. АН СССР, М., 1958. — 19. Краснов В. И. Научн. тр. Омск. с.-х. ин-та, вып. 61, 1966. — 20. Кудашев И. С. Доклады ВАСХНИЛ, вып. 8, 1956. — 21. Кудзин Ю. К. Сб. «Вопросы применения бактериальных удобрений». Изд. АН УССР, 1953. — 22. Кудзин Ю. К., Ярошевич И. В. Удобрение и урожай, № 9, 1958. — 23. Кудзин Ю. К., Ярошевич И. В., Власова Н. И. Земледелие, № 11, 1961. — 24. Кудзин Ю. К. Земледелие, № 11, 1962. — 25. Кудзин Ю. К., Ярошевич И. В. Сб. «Микроорганизмы и эффективное плодородие почвы» Тр. Ин-та микробиол. АН СССР, вып. 11, 1962. — 26. Кудзин Ю. К., Ярошевич И. В. Микробиология, № 31(6), 1962. — 27. Куртеков А. П. Агробиология, № 2, 1955. — 28. Литвинов Р. А. Влияние фосфоробактерина на плодородие торфянистых почв и химический состав растении кукурузы. Автореф. канд. дисс. Харьков, 1960. — 29. Мазепин К. Г. Зап. Воронежского с.-х. ин-та, вып. 30, 1964. — 30. Мазепин К. Г. Тр. Ин-та сах. свеклы и сахара, вып. II (I), 1964. — 31. Макаревский А. Ф. Сб. «Выращивание овощей». М., 1959. — 32. Мальцева Н. М. «Мікробіолог. журнал», № 23 (3), Киев, 1961. — 33. Мальцева Н. М. «Мікробіолог. журнал», № 23(4), 1961. — 34. Мальцева Н. М. Мікробіолог. журнал, № 23(1), Киев, 1961. — 35. Менкина Р. А. Тр. Ин-та с.-х. микробиол., вып. 12, 1961. — 36. Менкина Р. А. Сб. «Роль микроорганизмов в питании растений». Сельхозгиз, М., 1953. — 37. Менкина Р. А. Удобрение и урожай, 5, 1956. — 38. Менкина Р. А. Сб. «Вопросы почвенной микробиологии» Тр. Ин-та микробиол. Латв. АН ССР, № 2, 1956. — 39. Менкина Р. А. Сб. «Микроорганизмы и эффективное плодородие почвы». Тр. Ин-та микробиол. АН СССР, № 11, 1961. — 41. Менкина Р. А. Микробиология, № 32(2), 1963. — 42. Миненко А. К. Тр. Ин-та с.-х. центр. р-нов нечернозем. зоны, вып. 19, 1963. — 43. Миропольская И. М. Доклады ТСХА, вып. 119, 1966. — 44. Мишустин Е. Н., Наумова А. Н. Микробиология, № 31(3), 1962. — 45. Мишустин Е. Н. Сб. «Микрофлора почв северной и средней части СССР». Изд. «Наука», 1966. — 46. Наумова А. Н. Сб. «Микроорганизмы и эффективное плодородие почвы» Тр. Ин-та микробиол. АН СССР, № 11, 1962. — 47. Новикова А. Г. Агробиология, № 4, 1959. — 48. Новикова А. Г. Земледелие, № 4, 1963. — 49. Новикова А. Г. Условия эффективного применения фосфоробактерина на черноземах Кустанайской области Целинного края. Автореф. канд. дисс., Ульяновск, 1964. — 50. Овчаров К. Е. Витамины в жизни растений. Изд. АН СССР, 1955. — 51. Островский Я. Н.

Бюлл. «Достижения науки и передового опыта в с. х.», вып. 1. 1953. — 52. Пароносян А. К., Ходжаян Р. Н. Сб. «Вопросы микробиологии» АН Арм. ССР, вып. II, Ереван, 1961. — 53. Пискарева Л. Г. Бюлл. «Достижения науки и передового опыта в с. х.», вып. 1. 1953. — 54. Пономарева А. Сельское хозяйство Казахстана, № 10. 1956. — 55. Пронин М. Е., Акперов А. Д., Смыкова Н. П., Коллова М. Н., Гаврилова Л. Н. Сб. «За высокие урожаи зерновых культур», Воронеж, 1955. — 56. Пронин М. Е. Зап. Воронежского с.-х. ин-та, вып. 30, 1964 — 57. Пудова Е. В. Бюлл. научно-технической информации ин-та льна, вып 2. 1956. — 58. Самойлов И. И., Березова Е. Ф., Чернова А. С. Тр. Ин-та с.-х. микробиол., вып. 13. 1953. — 59. Самойлов И. И. Сб. «Вопросы питания растений и применения удобрений» М. Сельхозгиз, 1957 — 60. Самойлов И. И. Современное состояние производства и применения бактериальных удобрений. Совещ. по попр. наиболее эффект. способов использования минер., орган. и бактериальных удобрений МСХ СССР. М., 1957. — 61. Самцевич С. А. Сб. «Бактеріальні добрива та їх застосування» Сессия отд. землед. Ак. с.-х. наук УССР. Киев. 1959 — 62. Тэрвидзе И. И. Сб. «Получение и применение бактериальных удобрений». Изд. АН УССР, 1958. — 63. Тюрин И. В., Соколов А. В. Изв. АН СССР, сер. биол., 1958 — 64. Худяков Я. П., Возняковская Ю. М. Микробиология, № 25(2). 1956 — 65. Шарова Н. Л. Изв. [illegible] фил. АН СССР, вып. 1(2), 1955 — 66. Шепетина Ф. А. Сельское хозяйство Сев. Кавказа, № 4, 1959 — 67. Штанкин В. И. Виноградарство и виноделие, № 3, 1965 — 68. Штанкин В. И. Садоводство, № 5, 1966 — 69. Шустова Е. Н. Сб. «Микробиология на службе с. х.», М., 1959. — 70. Уфимцев Н. И. Научн. записки Луганского с.-х. ин-та, вып. 7. 1960 — 71. Черных З. П. Изв. Иркутского с.-х. ин-та, вып. 3(25), 1956. — 72. Эдельштейн В. И. Картофель и овощи, № 3. 1951 — 73. Юнг Л. А. Земледелие, № 10, 1954. — 74. Юрчук Е. Ф. Влияние фосфоробактерина [illegible] продукта витаминов группы В [illegible] растение и урожай гречихи и овса. Автореф. канд. дисс. Харьков. 1961. — 75. Якушевский Я. Н. Бюлл. «Достижения науки и передового опыта в с. х.», вып. 2, 1953 — 76. Cacciari I. Agrochimica, v. 10(2), 1966. — 77. Chandra Purna, Bollen W., Kadry T. A. Lragi soils representative of an ancicat site. «Soil Sci.», v. 1(4), 1962 — 78. Cooper R. Soils and Fertil, v. 22, 1959. — 79. Durner K., Mach F. Zentr. f. Bakt. Abt. II, 120(6), 1966. — 80. Fiedler H., Jahn-Deesbach W. Die Deutsche Landwirtschaft 12, 1956. — 81. Negrea A., Dumitru I., Corpode V. et al. Eficacitatea ingrasamintelor bacteriene in conditiile pedo-climatice de la Lugoi, Voicesti, Tecuci si Trifesti-Roman. «Lucrări Stiintifice. Centr. Exp. de Ingrăs. bacterienne, 11. 1960. — 82. Smith H., Allison F., Soulides D. Soil Sci of America Proceedings, v. 25(2), 1961.

Article entered on 13 February 1967.

END

FILMED

3-86

DTIC