MEANS OF CHEMICAL CONTAMINATION REDUCTION USING COMPOSITIONS OF VITAVAKS 220FF AND THERMOPHILIC METHANE FERMENTATION PRODUCTS FOR PRESOWING SEED TREATMENT

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Means of chemical contamination reduction using compositions of **vitavax 200FF** and complex growth regulator on the basis of thermophilic methane fermentation products (**TMFP**) were explored for presowing seed treatment of winter wheat on maize hybrids. **TMFP** compositions (1,61 l/t) together with disinfectant **vitavax 200FF** provided high performance of seed treatment while reducing disinfectant dose by 25% (2,25 l/t) – for maize hybrids and 50% (1,5 l/t) – for winter wheat, respectively and decreased disinfectant negative effect on seed germination and growth processes of crop seedlings. Results obtained testifies that investigated compositions are more environmentally safe and economically sound comparing to recommended disinfectant norms.

Introduction

With the help of different plant protectors and growth regulators it is possible not only to increase substantially the productivity of agriculture crops but also to enhance their resistance to difficult environment and phytopathogens [1, 2]. Numerous synthetic preparations are now widely produced. However their application in agriculture is limited by their high price and ecological consequences. Reducing chemical contamination by means of creation of complex preparations of growth regulators on the basis of natural origin, nutrition elements and compounds that increase plants resistance are in the sight of scientists during last years.

Among growth regulators produced from natural raw material with high efficiency most known are phytohormone concentrates, extracted from sea algae (maxicrop, nitrozyme, kerry enhancer) [3, 4, 5]. Other regulators (silk, immunocytophyte, emistim C) are complex preparations combining properties of growth regulators, biofungicides and immunistimulators [1, 2, 6].

TMFP is also a complex growth regulator produced from the wastes of ethanol production. **TMFP** contains vitamins of group B as well as phytohormones IAA and zeatin riboside [7]. **TMFP** accelerated growth of sugar beet, maize and wheat; it attenuated markedly the adverse effects of fungicides, herbicides and high temperatures thereby, promote environmental enhancement of farms where it was used. The objective of this research was to study the efficiency of different quantity ratios of disinfectant Vitavaks 220FF together with **TMFP** on various crops with the view of effective crops germ protection against complex of diseases under reduced disinfectant dose, improvement of plant growth parameters and lowering of synthetic load of farm lands.

Methods

Experiments were performed in the Institute of Plant Physiology and Genetics, National Academy of Science of Ukraine. Seeds of maize hybrids (*Kometa MV, Titan 220CV*) and winter wheat (*Yuna* kind) were diligently treated with incrusting compositions composed of different quantity ratios of disinfectant **vitavax 200FF** (3 l/t (recommended dose), 2,25 l/t, 1,5 l/t) and **TMFP** ((6,25 l/t, 3,23 l/t and 1,61 l/t).) Seeds were dried out to air-dry state, afterwards they were couched in pans filled with fried river sand that was systematically moisten with distilled water. Raw weight of 100 winter wheat germs was determined in 5 days after sowing. Raw weight of maize germs (28 – 30) was determined in 3 days after sowing. Seeds without treatment and treated with **vitavax 200FF** in recommended dose (3 l/t) and half-dose (1,5 l/t) were used as control.

Seeds mycoflora was determined using moist chamber method. 10 seeds were put in Petri dish on two layers of moistened filter paper and were endured in thermostat at temperature 25 °C during 18 days. Experiments were repeated ten times. First record was performed after 3 days. Surface of each seed with germ was examined under the microscope (×16) taking into account fungi that have appear.

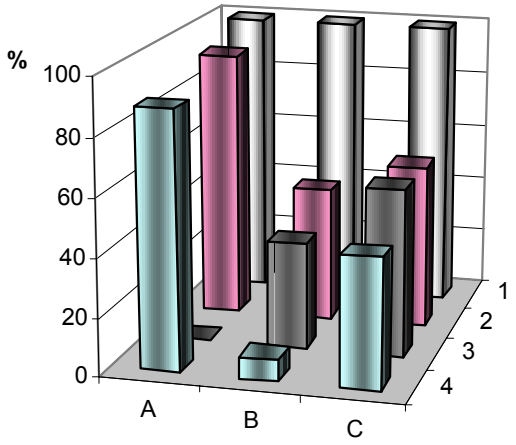
Fungi genus affiliation was determined depending on spores kind. Second record was performed after 10 days, third – after 18 days.

Results and Discussions

Results obtained indicate unalike sensibility of investigated grain crops on the effect of different quantity ratios of disinfectant **vitavax 200FF**.

Thus, **vitavax 200FF** decreased raw weight of winter wheat seedlings of *Yuna* kind by 11 and 7 % under usage of recommended (3 l/t) and half-dose (1,5 l/t) of disinfectant respectively **(Fig. 1)**.

Fig. 1. Influence of different quantity ratios of disinfectant vitavax 200FF on growth processes of investigated grain crops.
A *– winter wheat (*Yuna *kind);*
B *– maize hybrid Kometa MV;*
C *– maize hybrid Titan 220CV.*
1 *– control (without treatment);*
2 *– half-dose (1,5 l/t);*
3 *– 2/3 dose (2,25l/t);*
4 *– recommended dose (3l/t).*
*Variant A3 was not studied.



Disinfectant recommended dose decreased raw weight of maize hybrid *Kometa MV* seedlings by more then 90 %, and at the same time well-defined concentration dependence was noticed. Hybrid Titan 220CV turned out to be less sensible to disinfectant treatment – inhibiting effect of different **vitavax 200FF** doses was about 42 – 55 % (FIG. 2).

Inclusion of **TMFP** to incrusting compositions has affect growth processes of investigated grain crops in different ways.

Hybrid *Kometa MV* has showed essential (by 60 %) increasing of seedlings raw weight under the treatment with composition consisted of full dose of **vitavax 200FF** together with 3,23 l/t of **TMFP (table 1)**. Considerable (by 13 – 23 %) stimulation of growth activity was observed under treatment with compositions with decreased by 25% and 50% dose of **vitavax 200FF** plus **TMFP** (3,23 l/t and respectively, 1,61 l/t). Concerning hybrid *Titan 220CV* the best composition appear to be – **vitavax 200FF** 2,25 l/t together with **TMFP** 1,61 l/t.

Under different compositions of **vitavax 200FF** with **TMFP (table 2)** winter wheat seedlings raw weight has increased from 18% (3 l/t + 6,25 l/t) to 30 % (1,5 l/t + 1,6 l/t, respectively) .

Table 1. Influence of disinfectant vitavax 2200FF and its compositions with TMFP on raw weight increase of maize hybrids seedlings.

Variants of experiment	Kometa MV		Titan 220CV	
	Seedling's raw weight, mg	% to control	Seedling's raw weight, mg	% to control
Control (without treatment)	375 ± 4,3	100	759 ± 5,9	100
vitavax 200FF, 3 l/t	28 ± 0,6	7,5	340 ± 3,8	44,8
vitavax 200FF, 2,25 l/t	138 ± 2,0	36,8	441 ± 3,2	58,1
vitavax 200FF, 1,5 l/t	176 ± 2,7	46,9	435 ± 5,4	57,3
vitavax 200FF, 3 l/t +TMFP 3,23 l/t	258 ± 4,4	68,8	270 ± 4,9	35,6
vitavax 200FF, 3 l/t +TMFP 1,61 l/t	96 ± 2,73	25,6	290 ± 3,5	38,2
vitavax 200FF, 2,25 l/t +TMFP 3,23 l/t	227 ± 5,1	60,5	512 ± 3,4	67,5
vitavax 200FF, 2,25 l/t +TMFP 1,61 l/t	202 ± 2,9	53,9	689 ± 3,3	90,8
vitavax 200FF, 1,5 l/t +TMFP 3,23 l/t	151 ± 4,2	40,3	305 ± 2,7	40,2
vitavax 200FF, 1,5 l/t +TMFP 1,61 l/t	224 ± 2,7	59,7	314 ± 5,7	41,4

Table 1. Influence of disinfectant vitavax 2200FF and its compositions with TMFP on raw weight increase of winter wheat (Yuna kind) seedlings.

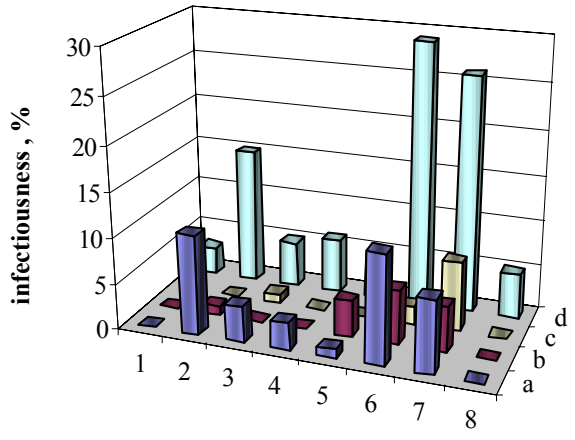
Variants of experiment	Raw weight of 100 seedlings	
	G	% to control
Control	8,3 ± 0,11	100
vitavax 200FF, 3l/t	7,4 ± 0,10	89
vitavax 200FF, 1,5 l/t	7,7 ± 0,05	93
TMFP, 6,25 l/t	9,0 ± 0,14	108,4
vitavax 200FF, 3 l/t + TMFP, 6,25 l/t	9,8 ± 0,06	118
vitavax 200FF, 1,5 l/t + TMFP, 6,25 l/t	9,8 ± 0,08	118
vitavax 200FF, 3l/t + TMFP, 3,18 l/t	10,6 ± 0,12	127,7
vitavax 200FF, 1,5 l/t + TMFP, 3,18 l/t	9,2 ± 0,17	120
vitavax 200FF, 3l/t + TMFP, 1,6 l/t	10,6 ± 0,06	127,7
vitavax 200FF, 1,5 l/t + TMFP, 1,6 l/t	10,8 ± 0,17	130

Received results indicates of well-defined synergistic effect of disinfectant **vitavax 200FF** and **TMFP** compositions on growth processes of winter wheat (*Yuna* kind) on the first stages of its development and different sensibility of maize hybrids (*Kometa MV*, *Titan 220CV*) to both disinfectant effect and **TMFP** and their various compositions.

Figure 2 shows, that under the treatment of winter wheat seeds with **vitavax 200FF** in compositions with **TMFP** disinfectant efficiency against mycelial fungi decreased from 2,7% to 16% under usage of recommended dose of disinfectant (3 l/t) and from 28% to 32% under the half-dose usage (1,5 l/t). Moreover, disinfectant efficiency decrease was more considerable, under usage of bigger quantities of **TMFP** preparation in compositions. Only 1,61 l/t of **TMFP** practically have not influenced disinfectant efficiency in our research.

It is necessary to notice, that disinfectant efficiency against mycelial fungi under the usage of half-dose of disinfectant **vitavax 200FF** (1,5 l/t) has not decreased comparing to variants, where recommended doses of preparation were used. Optimum ratio for presowing winter wheat treatment appear to be combination of **TMFP** 1,61 l/t together with half-dose of **vitavax 200FF**.

Fig. 2. Infectiousness (%) of winter wheat seedlings (Yuna kind) with phytopathogenic mycoflora.



a – Fusarium spp.;
b – Alternaria alternata;
c – Penicillium spp.;
d – Common iinfectiousness;
1 – vitavax 200FF, 3 l/t;
2 – vitavax 200FF, 3 l/t + TMFP, 6,25 l/t;
3 – vitavax 200FF, 3 l/t + TMFP, 3,18 l/t;
4 – vitavax 200FF, 3 l/t + TMFP, 1,6 l/t;
5 – vitavax 200FF, 1,5 l/t;
6 – vitavax 200FF, 1,5 l/t + TMFP, 6,25 l/t;
7 – vitavax 200FF, 1,5l/t+TMFP, 3,18 l/t;
8 – vitavax 200FF, 1,5 l/t + TMFP, 1,6 l/t

Results obtained in experiments wit h maize hybrids *Kometa MV* and *Titan 220CV* (Fig. 3), indicates on unalike treatment reaction between hybrids. Though in control iinfectiousness of maize hybrids *Kometa MV* and *Titan 220CV* with *Fusarium* spp. i *Penicillium* spp. was nearly the same, micromycet's reaction on treatment of hybrids was different.

Treatment with **vitavax 200FF** and his compositions with **TMFP** of hybrid *Kometa MV* seeds was more effective against *Fusarium* spp., while treatment of hybrid *Titan 220CV* seeds – against fungi of *Penicillium* genus.
Treatment efficiency was not affected much under the usage of **TMFP** together with disinfectant **vitavax 200FF**, though in some variants decrease of biological effectiveness of treatment was noticed, particularly under the usage of half-dose of disinfectant.

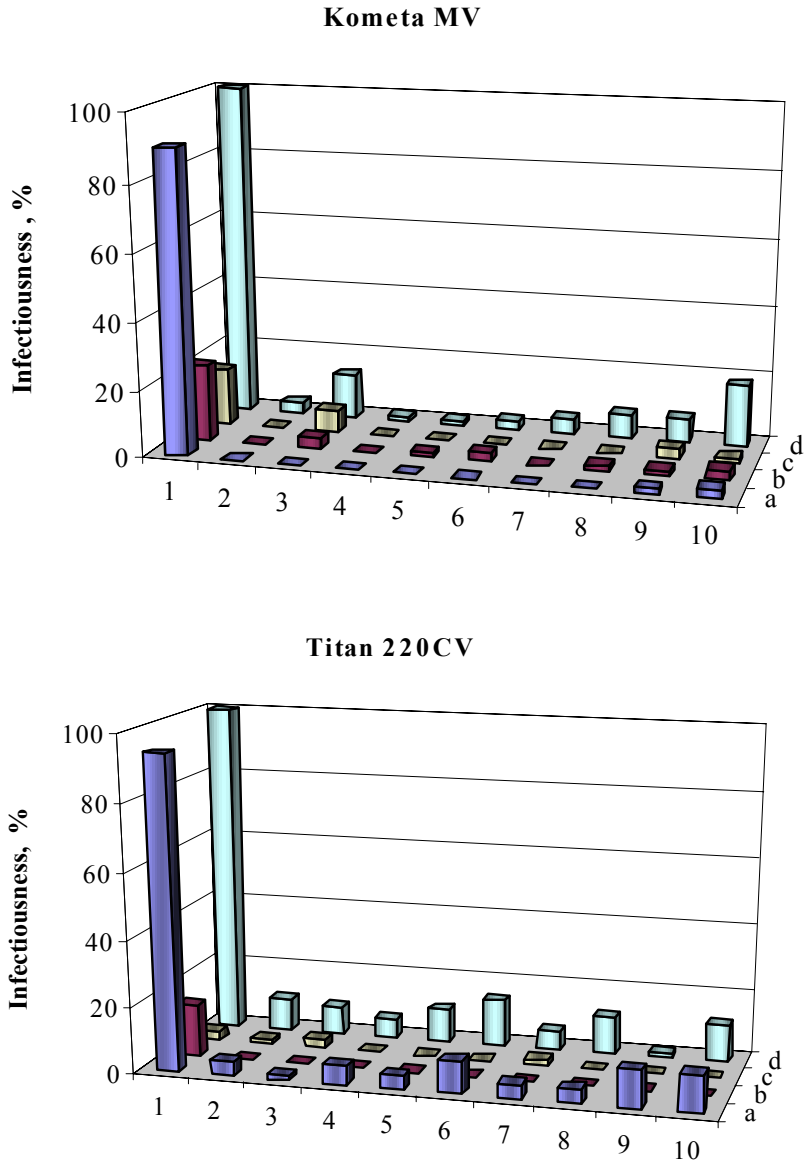


Fig. 3. Infectiousness (%) of maize hybrids seedlings with phytopathogenic mycoflora.
a – *Fusarium* spp.; **b** – *Penicillium* spp.; **c** – *Mucor* spp.; **d** – common
1 – control; **2** – vitavax 200FF, 3 l/t; **3** – vitavax 200FF, 3 l/t + TMFP, 3,23 l/t; **4** – vitavax 200FF, 3 l/t + TMFP, 1,61 l/t; **5** – vitavax 200FF, 2,25 l/t; **6** – vitavax 200FF, 2,25 l/t + TMFP, 3,23 l/t; **7** – vitavax 200FF, 2,25 l/t + TMFP, 1,61 l/t; **8** – vitavax 200FF, 1,5 l/t; **9** – vitavax 200FF, 1,5 l/t + TMFP, 3,23 l/t; **10** – vitavax 200FF, 1,5 l/t + TMFP, 1,61 l/t

Conclusions

Experimental data have shown that usage of plant growth regulators of natural origin amounting to protective-stimulating compositions reduces disinfectant negative effect on plant growth processes on early ontogenesis stages. 2,25 l/t of Vitavaks 220FF together with 1,61 l/t of TMFP turned out to be the optimum ratio for presowing seed treatment of maize hybrids. The optimum ratio for presowing seed treatment of winter wheat was combination of 1,61 l/t of TMFP together with half dose of disinfectant (1,5 l/t). Chosen compositions provide high treatment efficiency of reduced by 25 % (maize) and 50 % (winter wheat) disinfectant. Thus, it enables farm owners to use more environmentally safe and economically advantageous ways of seed treatment comparing to existent significantly lessen fungicides negative effect and thereby, promote environmental enhancement of agrocoenosises.

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