

# Statistical modeling of *Alfalfa mosaic virus* detection in alfalfa seed

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## INTRODUCTION

*Alfalfa mosaic virus* (AMV) is economically very important in Serbia causing a disease of alfalfa and many other field and vegetable crops. Alfalfa is the most important forage crop in Serbia, grown on 110.000 ha, while seed is a significant export commodity.



AMV: Crop deterioration and disease symptoms

## CONCLUSION

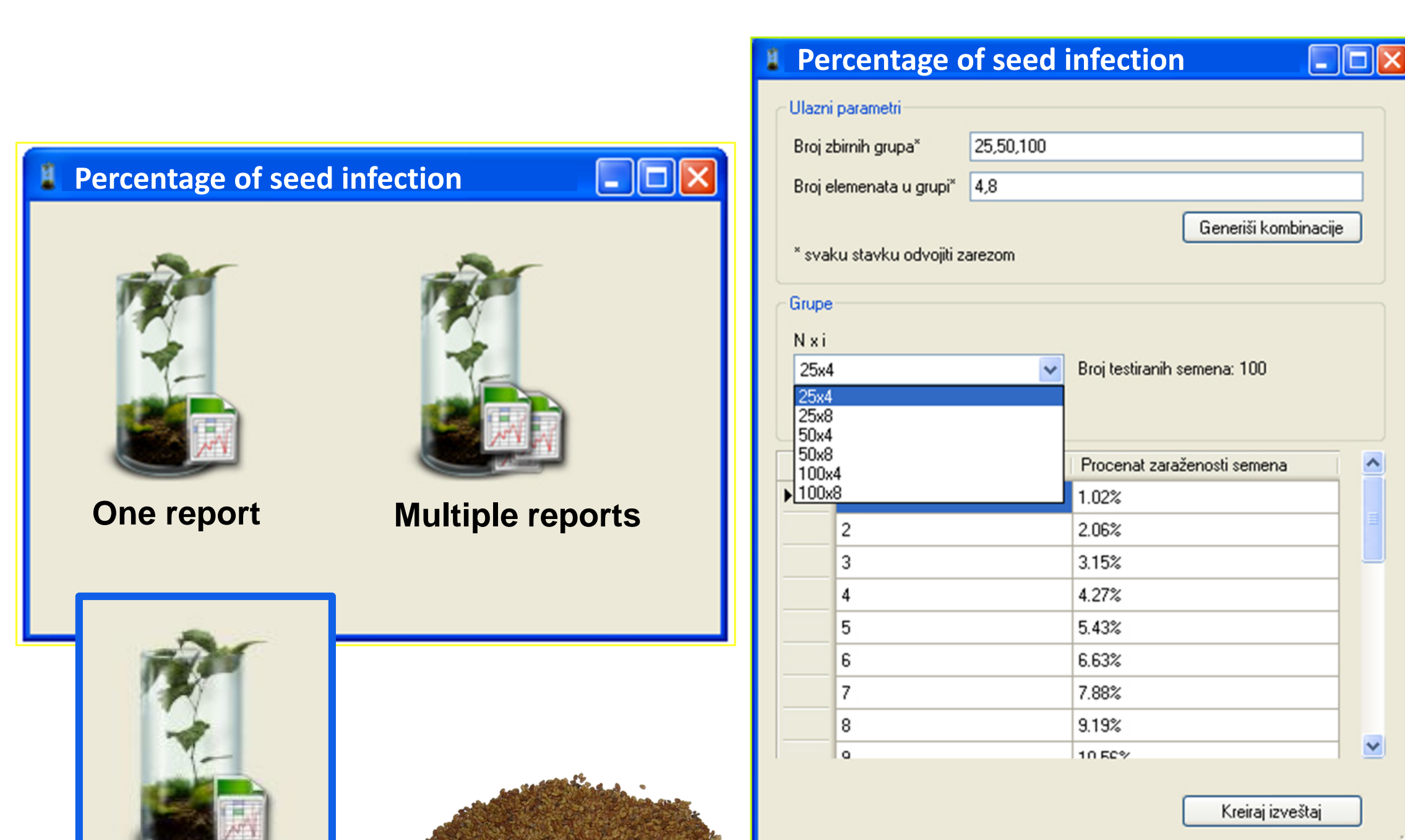
The protocol for AMV detection in alfalfa seed and development of GUI application based on multiple transfer method will be applied in standard phytosanitary diagnostic laboratories in Serbia in detecting the rates of seed infection and will be tested as model in reducing disease risk.

## GOALS

- Reevaluate the current Serbian law with nil tolerance to AMV seed infection
- Find suitable and reliable laboratory and statistical methods
- Develop Graphical User Interface (GUI) application based on statistical multiple transfer method
- Develop protocol for AMV alfalfa seed testing for phytosanitary diagnostic laboratories in Serbia
- Define 'threshold' levels for AMV infection in seed stocks

## RESULTS

### GUI application for calculation of seed infection, interface, initial formula and examples of output



### Multiple transfer method (MTM)

$$p^* = 1 - (1 - R/N)^{1/i}$$

Gibbs and Gower, 1960  
Ann. App. Biol. 48, 75-83

$i$  – number of elements in group;  
 $N$  – number of tested groups;  
 $R$  – number of infected groups;  
 $p^*$  – estimated proportion of infection.

i: 4, N: 25			i: 4, N: 100						i: 8, N: 50			
R	R%		R	R%	R	R%	R	R%	R	R%	R	R%
1	1.02		1	0.25	26	7.25	51	16.33	76	30.01	1	0.25
2	2.06		2	0.50	27	7.57	52	16.76	77	30.75	2	0.51
3	3.15		3	0.76	28	7.88	53	17.20	78	31.51	3	0.77
4	4.27		4	1.02	29	8.21	54	17.65	79	32.31	4	1.04
5	5.43		5	1.27	30	8.53	55	18.10	80	33.13	5	1.31
6	6.63		6	1.53	31	8.86	56	18.56	81	33.98	6	1.59
7	7.88		7	1.80	32	9.19	57	19.02	82	34.86	7	1.87
8	9.19		8	2.06	33	9.53	58	19.50	83	35.79	8	2.16
9	10.56		9	2.33	34	9.87	59	19.98	84	36.75	9	2.45
10	11.99		10	2.60	35	10.21	60	20.47	85	37.77	10	2.75
11	13.49		11	2.87	36	10.56	61	20.97	86	38.83	11	3.06
12	15.08		12	3.15	37	10.91	62	21.49	87	39.95	12	3.37
13	16.76		13	3.42	38	11.26	63	22.01	88	41.14	13	3.69
14	18.56		14	3.70	39	11.62	64	22.54	89	42.41	14	4.02
15	20.47		15	3.98	40	11.99	65	23.08	90	43.77	15	4.36
16	22.54		16	4.27	41	12.36	66	23.64	91	45.23	16	4.71
17	24.79		17	4.55	42	12.73	67	24.21	92	46.82	17	5.06
18	27.26		18	4.84	43	13.11	68	24.79	93	48.56	18	5.43
19	30.01		19	5.13	44	13.49	69	25.38	94	50.51	19	5.80
20	33.13		20	5.43	45	13.88	70	25.99	95	52.71	20	6.19
21	36.75		21	5.72	46	14.28	71	26.62	96	55.28	21	6.58
22	41.14		22	6.02	47	14.68	72	27.26	97	58.38	22	6.99
23	46.82		23	6.33	48	15.08	73	27.92	98	62.39	23	7.41
24	55.28		24	6.63	49	15.49	74	28.59	99	68.38	24	7.85
25	100		25	6.94	50	15.91	75	29.29	100	100	25	8.30

### AMV detection at very low seed infection

- ✓ GUI application using MTM
- ✓ Increased the number of tested
- ✓ Samples consisted of 10, 20 and 50 seeds
- ✓ Preliminary tests for testing compound samples

- ✓ Lowered the costs retaining the sensitivity
- ✓ Lowered the number of analyzed samples
- ✓ Samples tested in groups of 25, 50 and 100
- ✓ Estimation of expected infection level
- ✓ Sensitivity < 0.1% seed infection rate