2019-20 FLOWER SEED GERMINATION REFEREE

REGION IV SOUTHWEST

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Purpose of referee

- To compare the AOSA and ISTA final counts of one flower seed species, *Matthiola incana* (common stocks)

- Results could be used for an AOSA Rules change proposal.

- One possible outcome would be to harmonize the ISTA and AOSA rules for germination testing on this species.

Background

- The final counts for many flower seed species are considerably earlier for AOSA than they are for ISTA.
- Some flower seed species do not appear to reach the maximum potential given the final count days listed in AOSA.
- The coordinators of this referee compared AOSA and ISTA Rules for 17 species of flower seeds.
- After review, we decided to conduct a referee on *Matthiola incana* (common stocks). This species has common germination temperature and media requirements for AOSA and ISTA and differs only in the number of days for the final count.
- Similar referees were conducted on six different flower seed species from 2017-2019, which resulted in AOSA Rules changes in 2018 and 2019.

Background, cont.

- A call for referee participants was sent out to all AOSA and SCST members.

- Potential participants were asked to fill out a survey via Survey Monkey with the following questions:

1. How many years' experience do you have in seed testing?

2. How many samples of stocks (*Matthiola incana*) do you evaluate for germination each year?

Survey Results

- 17 analysts responded to the survey. Because of the limited amount of testing material, the participation was limited to the 10 analysts (from 10 different labs) with the most testing experience, particularly with stocks. Here are the survey results from the 10 analysts:

1. How many years' experience do you have in seed testing?

   Range from 16 years to 42 years(!), average of 27 years

2. How many samples of stocks (*Matthiola incana*) do you evaluate for germination each year?

   Range from 2 to 300, average 59 samples

Materials and Methods

- Three lots of varying quality of *Matthiola incana* were selected from Sakata Seed Company for comparison of AOSA and ISTA Rules.

- Two samples from each lot (six samples total, labelled Samples A-F) were prepared and sent out to ten laboratories, in eight different states. Participants were asked to test each sample using 4 replicates of 100 seeds, using only (two layers of) white blotters which were provided, in 20°C light. Three samples (Samples A-C) were tested and finished on 7 days final count (AOSA) and three different samples of the same lots (Samples D-F) were tested and finished on 14 days final count (ISTA).

Evaluation

- The participants were instructed to use the Brassicaceae family seedling evaluation descriptions on pages 34-35, Volume 4 of the AOSA Rules; evaluation sheets from the ISTA Handbook on Flower Seed Testing for *Matthiola* spp. were also provided. Both evaluation descriptions are similar and require a primary root.

Results

- All ten participating laboratories reported results.

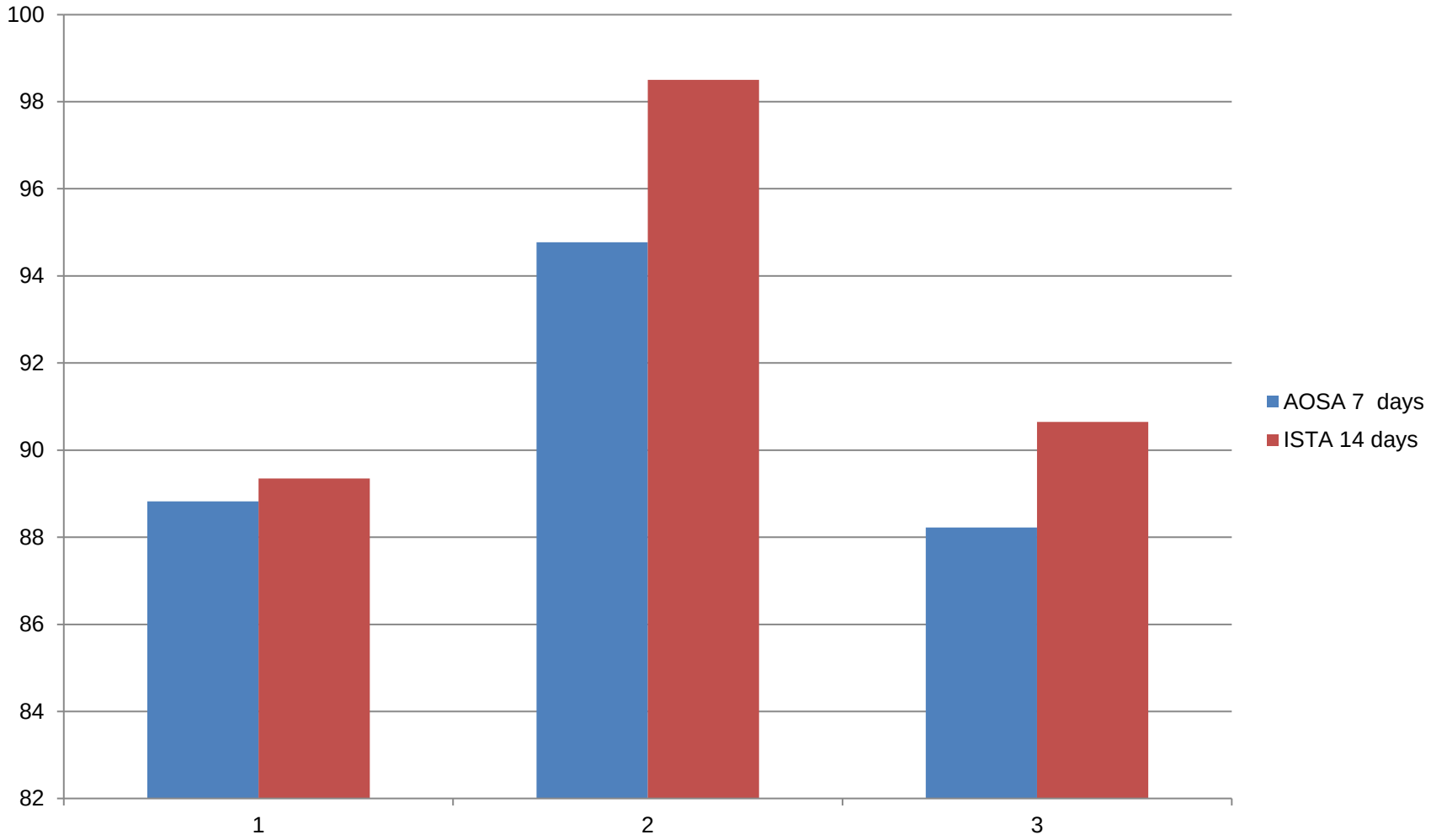
- The results are summarized in the following slides.

Note: Samples A and D were the same lot (Lot 1);
Samples B and E were the second lot (Lot 2), and
Samples C and F were the third lot (Lot 3).

Matthiola incana Results

Lot	Final % Germination		Difference
	AOSA 7 days	ISTA 14 days	
1	88.825	89.35	.525
2	94.775	98.5	3.725
3	88.225	90.65	2.425
Average	**90.6%**	**92.8%**	**2.2%**

Matthiola incana Results



Discussion

- The average difference in germination of the three lots in this study was an additional **2.2%** when the test was finished on 14 days (ISTA) as compared to 7 days (AOSA).
- This difference was most pronounced on the highest quality lot (Lot 2).
- It appears that some additional germination may be possible on stocks when they are finished on only 7 days required by AOSA.

Data Analysis

The following statistical analysis was prepared by Dr. Riad Baalbaki:

Table 1. Analysis of variance of the effect ($p \leq 0.01$) of testing method (AOSA and ISTA) and labs on germination results of three *Matthiola* samples.

Sample A-D	***df***	***MS***	***F***	***Sig.***
Method (M)	1	0.347222	0.048481	no
Labs (L)	8	67.40972	9.412088	yes
M x L	8	14.90972	2.081771	no
Error	54	7.162037		

Sample B-E	*df*	*MS*	*F*	*sig*
Method (M)	1	95.68056	35.20784	yes
Labs (L)	8	11.42014	4.2023	yes
M x L	8	10.39931	3.826661	yes
Error	54	2.717593		

Sample C-F	*df*	*MS*	*F*	*sig*
Method (M)	1	56.88889	6.578158	no
Labs (L)	8	46.5	5.376874	yes
M x L	8	17.76389	2.054069	no
Error	54	8.648148		

Data Analysis, cont.

Table 2. Differences in mean percentage germination of *Matthiola* averaged over all labs, using two methods, AOSA and ISTA (based on ANOVA results; Table 1).

Sample	Method	Mean germination (%)	Difference between the two methods
A-D	AOSA	89.50	NS
	ISTA	89.36	
B-E	AOSA	96.61	**
	ISTA	98.92	
C-F	AOSA	89.44	NS
	ISTA	91.22	

^{NS}Not significant; **Significant at $p \leq 0.01$.

Data Analysis Summary:

- Analysis of variance results (Table 1) indicated that the two methods (AOSA and ISTA), i.e., extending the germination period from 7 to 14 days, tended to increase the final percentage germination when results were averaged over all labs, but these increases were not statistically significant for two out of three samples, while significant for one of the tested samples (sample B-E). Sample B-E had the highest germination, so this might indicate lots with high germination capacity might benefit from extending the test period, while lots with good to acceptable capacity might not. Analysis of variance results also indicated that results among the 10 labs significantly varied and were not uniform. Keep in mind that the ANOVA results tend to be more sensitive to differences than tolerances, and so many labs might be within tolerance for each sample, but the more sensitive test (ANOVA) would show lack of uniformity.

Summary, cont.

- Table 2 compares the germination of the two methods, averaged over all labs (i.e., disregarding lab differences). As above, the differences are not significant for two samples, but significant for B-E. Notice that the difference between AOSA and ISTA for B-E is small and would be within tolerance, but according to the analysis, although this difference is small, it is real and not due to chance. One can argue that this real difference is of no practical effect, or conversely, that ISTA's method is better since it reflects the maximum potential due to the extended germination period.

Conclusion

At this time it is felt that the data produced from this referee is not strong enough to support an AOSA Rules change proposal. However, there is some evidence that extending the final count of *Matthiola* could benefit some lots. Further study on additional lots might be beneficial.

Thanks to participating laboratories

- Eurofins Biodioagnostics, Inc., WI
- Harris Seeds, Rochester, NY
- MD Seed Analysis, CA
- New Mexico State Seed Lab
- Ohio Seed Improvement Association
- Pan American Seed, IL
- Precision Seed Testing, CO
- Ransom Seed Lab, CA
- Sakata Seed Company, CA
- SGS Brookings, SD

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And thanks to Riad Baalbaki of CDFA for the statistical analysis

Questions?

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