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TREND ANALYSIS IN 1000 SEED WEIGHT TESTING USING A COUNTER

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ABSTRACT

Accuracy and random selection of seeds when testing the 1000 seeds weight in the laboratory is of great importance in order to ensure the representativeness of the sample and precise information for further packaging process. The aim of this research was to check whether the laboratory seed counter selects seeds by shape and size and whether there is a trend during operation at maximum and reduced speed. Ten species of different seed sizes were used. Ten replicates of 100 seeds were counted by counter, the number of seeds was manually checked and the weight measured. The analysis of the obtained results showed that the counter is precise, but weight results showed selection of smaller seeds (*Capsicum annuum* and *Glycine max*) at maximum counting speed. Trend of larger seed selection was observed in *Medicago sativa* and pelleted *Beta vulgaris*. Slower counting (50% of the maximum speed), ensured precise counting without trends.

Keywords: trend, 1000 seed weight, seed counter

INTRODUCTION

Monitoring and control of laboratory equipment is one of the requirements of accreditation standards for seed testing laboratories (SRPS ISO/IEC 17025, 2017; ISTA 2018). The period and method of control depends on the frequency of use of the equipment, its age, etc. In Seed Testing Laboratory of the Maize Research Institute Zemun Polje, seed counter is used to speed up the testing of 1000 seeds weight, and its counting accuracy is regularly checked once a year. However, in the practice so far, no attention has been paid whether the seed selection occurs during the operation of the counter. Accuracy and random selection of seeds when testing the 1000 seeds weight in the laboratory is of great importance in order to ensure the representativeness of the sample and precise information for further packaging process. Thousand seed weight is very important seed quality parameter and is often included in seed research projects (Tabakovic et al., 2021; Wu et al., 2018). According to the ISTA Rules (2022) 1000 seed weight can be determined by two methods: by counting the whole fraction of pure seed and by counting replications of 100 seeds. In both cases, the counting can be performed manually or by counter. Different apparatus can be used for obtaining working sample for 1000 seed weight. When 100 seed replicates are counted they are afterwards used for germination testing. So imprecise counting, and selection of lighter/heavier seed will be reflected in germination test also. The aim of this research was to check whether the laboratory seed counter tendentiously selects seeds by shape and size and whether there is a trend during operation at maximum and reduced speed.

MATERIAL AND METHOD

Ten species of different seed sizes (*Capsicum annuum*, pelleted seed *Beta vulgaris*, *Brassica napus*, *Medicago sativa*, *Raphanus sativus*, *Sinapis alba*, *Triticum aestivum*, *Helianthus annuus*, *Glycine max* and *Zea mays*) were used. Ten replications of 100 seeds were counted. After counting each replicate by the counter, the number of seeds was manually checked and the weight measured.

The Contador optical counter with integrated vibration channel was used. The counter was set to two counting speeds (maximum speed set automatically and 50% of maximum speed). The feed container was changed depending on the size of seed to be counted.

Obtained results were plotted in Excel graphs and linear trend lines added. Trend line formulas and R^2 values were analyzed for presence of seed selection. Value of 0.3 for R^2 was taken as a limit.



Figure 1. Photo of the seed counter used in this study

RESULTS AND DISCUSSION

Trend analysis quantifies and explains trends and patterns in a “noisy” data over time. A “trend” is an upwards or downwards shift in a data set over time (Glen, 2022).

Trend analysis in this paper involved observation of values distribution (100 seed weight replication), i.e. dispersal of points on the graph. A random distribution of points confirms that there is no trend. If values had gradually decreased, it would have indicated selection of seed from larger to smaller (presence of trend).



Figure 2. Hundred seed weight in 10 replicates for 10 species obtained by counter at maximum (blue bar) and reduced speed (orange bars) and related linear trend lines

Obtained results are presented on the Graph 1 separately for each tested species. At maximum speed, a trend appears during the operation of the counter, for certain types of seeds. In the species *Capsicum annuum* and *Glicine max*, a trend from smaller to larger seeds was observed (trend line is climbing upwards). In the case of *Medicago sativa* seeds and pelleted *Beta vulgaris* seeds, a trend from larger to smaller was observed (trend line is oriented downwards). Initial hypothesis that seed counter during vibration would select smaller seed was just partially approved. Those data indicate that both seed size and seed shape affect the counting process. At reduced speed (50% of the maximum), there was no trend during the operation of the counter, for all observed types of seeds. In future, during regular laboratory practice care will be taken in order to achieve representativeness. For the species where a trend at maximum speed was observed, the speed on the counter will be reduced to 50%, or counting will be performed manually.

Final conclusion of trend analyses are presented in Table 1, together with average 1000 seed weight results. Existence of a trend at maximum speed, in the case of seeds of certain species, was not reflected on 1000 seed weight (average values were almost identical). Although the average value for 1000 seed weight is not affected by potential selection during counting replicates, trends in selection should be avoided since replicates are further used in the germination tests which can be affected. Positive correlation between germination and 1000 seed weight was observed by Knezevic et al. (2014) on wheat seeds, while Stanisavljevic et al. (2013) reported non-significant correlated between those two parameters in testing *Festuca rubra*.

Table 1. Trend analysis and average results for 1000 seed weight obtained by counter operated at maximum (100%) and reduced (50%) speed

Species	100% speed		50% speed		Average 1000 seed weight (g)	
	Trend analysis	R ²	Trend analysis	R ²	100% speed	50% speed
<i>Capsicum annuum</i>	Trend from smaller to larger	0.38	No trend	0.02	6.976	6.985
<i>Beta vulgaris</i> pelleted seed	Trend from larger to smaller	0.50	No trend	0.06	20.84	21.01
<i>Brassica napus</i>	No trend	0.29	No trend	0.29	3.939	3.969
<i>Medicago sativa</i>	Trend from larger to smaller	0.55	No trend	0.08	1.918	1.896
<i>Raphanus sativus</i>	No trend	0.16	No trend	0.06	7.460	7.378
<i>Sinapis alba</i>	No trend	0.03	No trend	0.04	5.735	5.733
<i>Triticum aestivum</i>	No trend	0.23	No trend	0.22	43.37	44.30
<i>Helianthus annuus</i>	No trend	0.04	No trend	0.04	66.15	65.98
<i>Glycine max</i>	Trend from smaller to larger	0.75	No trend	0.26	141.2	144.2
<i>Zea mays</i>	No trend	0.03	No trend	0.05	336.1	330.5

CONCLUSION

Obtained results showed that the counter is precise, but weight results showed selection of smaller seeds (*Capsicum annuum* and *Glycine max*) at maximum counting speed. Trend of larger seed selection was observed in *Medicago sativa* and pelleted *Beta vulgaris*. Slower counting (50% of the maximum speed), ensured precise counting without trends.

The results of these analyses indicate the importance of checking the equipment both in terms of accuracy of counting and selection of seeds in order to obtain accurate test results for the 1000 seed weight.

REFERENCES

1. Glen Stephanie (2022). Trend Analysis: Simple Definition, Examples. From StatisticsHowTo.com: Elementary Statistics for the rest of us! <https://www.statisticshowto.com/trend-analysis/>
2. ISO/IEC 17025:2017. General requirements for the competence of testing and calibration laboratories.
3. ISTA (2018). ISTA Accreditation Standard for Seed Testing and Seed Sampling. Version 6.1. International Seed Testing Association. Zurich, Switzerland.
4. ISTA (2022) International Rules for Seed Testing. International Seed Testing Association. Zurich, Switzerland.
5. Knežević Jasmina, Đokić D., Terzić D., Poštić D., Đukanović Lana, Tošković Snežana, Tmušić Nadica (2014). Comparative analysis of the characteristics of different types of wheat seeds. *Selekcija i semenarstvo*, Vol. XX (2014) broj 1, 55-62.
6. Stanisavljević R., Đokić D., Terzić D., Milenković Jasmina, Beković D., Đukanović Lana, Štrbanović R. (2013). Seed yield of red fescue (*Festuca rubra* L.) and correlation dependence with yield components and seed quality. *Selekcija i semenarstvo*, Vol. XIX, No 1, 1-9.
7. Tabaković Marijenka, Oro Violeta, Stanisavljević R., Štrbanović R., Sečanski M. (2021). Quality assessment of hybrid maize seeds according to their shape and size. *Journal on Processing and Energy in Agriculture*, 25, 28-31.
8. Wu Wenhua, Zhou Lei, Chen Jian, Qiu Zhengjun and He Yong (2018). Gain TKW: A Measurement System of Thousand Kernel Weight Based on the Android Platform. *Agronomy*, 8, 178; doi:103390/agronomy8090178

ANALIZA TRENDU U PROCESU ISPITIVANJA MASE 1000 SEMENA PRIMENOM BROJAČA

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Praćenje i kontrola rada laboratorijske opreme je jedan od zahteva standarda za laboratorije za ispitivanje semena. Period i način kontrole zavise od učestalosti korišćenja opreme, njene starosti itd. U Laboratoriji za ispitivanje semena Instituta za kukuruz „Zemun Polje“, brojač semena koristi se u ispitivanju mase 1000 semena radi ubrzanja procesa rada i jednom godišnje se redovno proverava njegova tačnost brojanja. Međutim, u dosadašnjoj praksi nije se obraćala pažnja da li prilikom rada brojača dolazi do selektivnog izbora semena koje se broji. Preciznost i slučajan izbor semena kod ispitivanja mase 1000 semena u laboratoriji je od velike važnosti kako bi se obezbedila reprezentativnost uzorka i ispravno donela odluka o daljem procesu pakovanja. Određivanje mase semena prema ISTA Pravilima se može izvesti na dva načina: brojanjem cele frakcije čistog semena i brojanje ponavljanja od po 100 semena. U oba slučaja brojanje se može izvesti ručno ili korišćenjem brojača. Cilj ovog istraživanja je provera da li laboratorijski brojač semena u toku svog rada, u zavisnosti od brzine, selektuje seme po obliku i veličini i da li postoji trend. U radu je ispitivano 10 vrsta različite krupnoće semena (*Capsicum annuum*, peletirano seme *Beta vulgaris*, *Brassica napus*, *Medicago sativa*, *Raphanus sativus*, *Sinapis alba*, *Triticum aestivum*, *Helianthus annuus*, *Glycine max* i *Zea mays*). Brojač je podešen na dve brzine brojanja (maksimalna brzina automatski zadata i 50% od maksimalne brzine). Brojano je 10 ponavljanja po 100 semena. Posle svakog ponavljanja izbrojanog na brojaču, ručno je proveravan broj semena i merena je masa. Analizom dobijenih rezultata utvrđeno je da brojač precizno broji, a na osnovu rezultata izmerene mase uočeno je da se na maksimalnoj brzini pojavljuje trend prilikom rada brojača kod vrsta *Capsicum annuum* i *Glycine max* (selektovanje semena od sitnijeg ka krupnijem). Kod semena *Medicago sativa* i peletiranog semena *Beta vulgaris*, uočen je trend selektovanja semena od krupnijeg ka sitnijem. Prilikom sporijeg brojanja (50% od maksimalne brzine), ne pojavljuje se trend prilikom rada brojača, kod gore navedenih vrsta semena. Za ostale vrste nije uočen trend (proseci mase 1000 semena za obe posmatrane brzine su skoro identični). Rezultati ovih analiza ukazuju na važnost provere opreme kako u smislu tačnosti brojanja tako i selektovanja semena u cilju dobijanja tačnih rezultata ispitivanja mase 1000 semena.

Ključne reči: *trend, masa 1000 semena, brojač semena*