ORGANIC SEED PRODUCTION IN THE CZECH REPUBLIC

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Abstract

The Council Regulation (EC) No. 834/2007, and the Commission Regulation (EC) No. 889/2008, lay down the law to solely use organic seeds in order to establish organic crop stands. The seed must originate from plants being grown in compliance with the organic farming rules for at least one generation. Seed reproduction is an extremely difficult process. The reproduction crop stand and seed must meet the requirements of the seed certification and authorization procedure as conventional plants and seed do, but organic farming does not allow the use of any pesticides or mineral nitrogenous fertilizers, etc. Organic farmers may use certified organic seeds or farm saved seed in order to establish the crop stand. They may also apply for an exception (derogation) and use the conventional untreated seed. Quality of certified seed is protected by the Seed law and the regulations. Certified seed guarantees basic seed quality for the farmers. But seed controll system cannot express the biological value. The differeces in seed quality are connected to propagation conditions at the farm and also level of agrotechnology applied at the seed multiplication farm. Important is also care about seed quality from seeding companies. Our manuscript is aimed on the evaluation of seed certification system in the Czech Republic. Thanks to the seeding companies (ZZN Pelhřimov and PRO-BIO s.r.o.) were obtained results from seed quality analysis. Our results brings overview about most frequent reasons for nonrecognition of organic seed, originated from organic farming. Our results also provides for the farmers recommendation how to produce high quality seed.

Key words: organic farming, cereals, seed quality and production

Seed management plays a significant part of plant production (Serpolay *et al*., 2011). Good-quality seeds have a positive effect on productivity, quality and vitality of the crop stand and the overall economic yield. Therefore, the good-quality seeds provide a basis for successful economy and field crop growing. The quality of seeds is influenced by a lot of factors, e.g. soil, environmental conditions, farming technology and after-harvest seed manipulation and treatment. A producer and a treater of seeds also influence the quality of seeds (Hosnedl, 1997).

The conventional and the organic farming systems are based on different approaches to seed and plant production but they have to comply with the same legislation and follow the same rules (Capouchová *et al*., 2012). The conventional and the organic seed productions are different as the organic farming meets some specific requirements. It is more difficult and more expensive to produce certified organic seeds than the conventional ones (Serpolay *et al*., 2011). Total amount of the offered organic seeds is very limited and small. Offer is much smaller than demand. There are just a few species and varieties too, range of the offered species and varieties is very narrow (Capouchová *et al*., 2012).

The organic farming has vastly developed in the Czech Republic recently. However, perennial grasslands prevail there and a ratio of organic arable land stays very low in the Czech Republic. Efficiency of the organic cereal farming also stays low there (Moudrý *et al*., 2013). Legally binding rules and legislation on the organic farming limits or bans all the additives strictly or completely. Therefore, good-quality seeds play role of the essential intensification measure (Hosnedl, 1997). There are big differences in yield between the same conventional and organic varieties in the Czech Republic (bigger than abroad). It is caused, among others, by a lack of knowledge of the organic seeds and a minimum use of the certified organic seeds in the Czech Republic (Capouchová *et al*., 2012).

This article mostly aims at evaluation of quality of the conventional and certified organic seeds. It partly aims at evaluation of availability of

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the certified organic seeds in the Czech Republic in 2013 too.

MATERIAL AND METHOD

Samples of the certified conventional seeds were collected from the following agricultural businesses in compliance with the public notice no. 61/2011: Černovice, Nová Bystřice, Želiv, and Jaroprodukt s.r.o. as well. All the samples were also collected from the organic farm in Sasov and from Mr. Vaněk's organic farming in Okříšky. Fifteen samples in total were collected there and analysed immediately (in spring 2014).

Laboratory tests were done in compliance with the Act No. 219/2003 Coll. The testing methodology is the elementary and essential basis for all the tests that are necessary for the certification and authorization procedure (Dobiášová, 2012). All the samples were tested and examined according to the Methodology of Seed Testing. Seeds (all species and categories) have to meet the seed quality requirements. The requirements have been imposed by the public notice no. 129/2012 Coll.

An aggregate lab sample was created and adjusted by a seed gravity separator. A tasting sample of 1,000 seeds was separated from the aggregate sample. We used the tasting sample of 1,000 seeds in order to separate different plant seeds from the sample. The elementary sample weighed 120 g. We used the sample in order to examine and count a percentage of clean seeds (a cleanliness of seeds).

We tested and analysed the following parameters: humidity, germinability, size grading, separation of different plant species, cleanliness percentage. We counted a percentage of hulls in were covered with long awns, longer than their bodies (in %). We also counted a percentage of naked barley caryopses in hulls (in %). All these tests make part of the certification and authorization procedure. We counted a one thousand grains weight too.

RESULTS AND DISCUSSIONS

As the above mentioned results of our experiments on the certified conventional and organic seeds show, all the samples comply with the Act No. 219/2003 Coll. (see Tables 1–3). The sample seeds of "Potenzial", a winter wheat variety, that were harvested in 2010 are less germinable than the others (74% of the germinability of the other varieties, see Table 2). The tested seeds of "Potenzial" variety are probably less germinable because they are too old. Such a reduction in germinability may be caused by a seed germ that consumes all the storage elements needed, or by insects and microflora damaging seeds. On the other hand, neither the low nor the high seed germinability does not assure any good emergence index automatically. A correlation between emergence and germinability is usually low (Hosnedl, 1997). There is no best before date on written appending labels of the seed packages. It is considered inconsistent with the seed certification and labelling laws. A prolongation of the cereal seeds is not obligatory either. A quality of seeds (and a germinability of seeds as well) depends on a supplier.

Well-treated seeds have always a higher emergence index. The emerged plants are more resistant to harmful effects and organisms (Prokinová, 2012). However, we realised that quality of treatment of the conventional seeds may pose problems. See several examples of the seed treatment in *picture 1*.

The seed treatment control does not make part of the certification and authorization procedure. Treated samples are taken randomly, the maximum amounts of 10% of a supplier's seeds are taken from the certification and authorization procedure parties (in compliance with the public notice no. 129/2012 Coll.). They undergo a biological test. One sample costs 50 EUR in the Czech Republic (such a price is similar to the price paid to the Health Institute). The photometric method of a determination of dye distribution (it is contained in treatment disinfectants) on a caryopsis surface in not used in the Czech Republic. A stereomicroscope and a special computer program are typical for such a method. Considering the quality of treated seeds (see *picture 1*), the determination of dye distribution on a caryopsis surface should play obligatory part of the seed certification procedure.

All the tested certified organic seeds complied with the legislative quality regulations. One of the samples called Andrus was treated with a permitted substance called Polyversum (see *table* 3). The organic seeds which do not meet the qualitative requirements and criteria are allowed to be treated with biological substances. The biological substances can undergo a careful selection (Prokinová, 2011). Polyversum or Supresivit are two substances widely used in the Czech Republic. According to Prokinová et al., (2015), winter wheat species can be treated with a substance called *Clonostachys rosea* (it is based on a soil fungus). According to El-Naimi *et al*. (2000), dried skimmed milk can be used as a biological alternative to all the chemical substances.

Table 1

Quality parameters of conventional seed

Species	Spring barley					Winter barley
Variety	Kango	Malz	Malz	Laudis 555	Sebastian	Paso
Seed generation	Basic seed/E	Certified seed/C1				
Harvest year	2013					
Treatment	treated					
Location of sampling	ZDČernovice	DZV Nova	DZV Nova	ZD Želiv	ZD Želiv	DZV Nova
Cleanness	99.9%	99.7%	99.8%	99.9%	99.6%	98.9%
Harmless dirt	0.1%	0.3%	0.2%	0.1%	0.4%	1.1%
Specification harmless dirt	Broken seed	Broken s.	Broken s.	Broken s.	Broken s.	Dust
Other plant species seed	0%	0%	0%	0%	0%	0%
Germination						
Standard springs	89%	90%	95%	94%	94%	89%
Fresh nongerminated seed	0%	0%	0%	0%	0%	0%
Deformed springs	9%	8%	4%	4%	5%	5%
Dead seed	2%	2%	1%	2%	1%	6%
TGW	48.0 g	49.1 g	47.1 g	47.5 g	48.6 g	42.0 g
Grains under sieve 2.2 mm	trace	0.3%	0.2%	0.2%	0.4%	2%
Grains with awn	0%	0%	0%	0%	0%	0.4%
Moisture	14.1%	13.9%	13.9%	14.7%	14.7%	14.7%
Other plant species in 1 kg	0	0	0	0	1x wheat	0

Table 2

Quality parameters of conventional seed

Species	Winter wheat					
Variety	Meritto	Genius	Midas	Avenue	Potenzial	Dagmar
Seed generation	Certified seed/C1					
Harvest year	2013	2013	2013	2013	2010	2013
Treatment	treated					
Location of sampling	DZV Nova	DZV Nova	Jaroprodukt	ZD Želiv	ZD Želiv	Jaroprodukt
Cleanness	99.6%	99.4%	99.7%	99.8%	99.3%	99.7%
Harmless dirt	-	0.6%	-	0.2	0.7%	0.3%
Specification harmless dirt	0.4%	Broken seed + dust	0.3%	Broken seed	Broken seed + dust	Broken seed
Other plant species seed	broken	0%	broken	0%	0%	0%
Germination						
Standard springs	96%	96%	93%	97%	74%	96%
Fresh non germinated seed	0%	0%	0%	0%	0%	0%
Deformed springs	2%	4%	4%	2%	15%	4%
Dead seed	2%	0%	3%	1%	11%	0%
TGW	47.4 g	45 g	45.0 g	44.0 g	46.6 g	50.1g
Grains under sieve 2.2 mm	0.4%	0.7%	0.3%	0.2%	1.20%	0.3%
Grains with awn in 1 kg	1 pcs	0	0	0	0	2 pcs
Moisture	14.8%	13.9%	14.3%	14.1%	15%	15%
Other plant species in 1 kg	0	0	0	0	0	0

Table 3

Quality parameters of organic seed

Species	Spring triticale	Spring wheat	Naked oat
Variety	Andrus	Granny	Saul
Seed generation	Certified seed/C1	Certified seed/C1	Certified seed/C1
Harvest year	2013	2013	2013
Treatment	Treated by Polyversum 0,5 kg/t	Untreated	untreated
Location of sampling	Biofarma Sasov	Vaněk, Okříšky	Vaněk, Okříšky
Cleanness	99.9%	99.9%	99.8%
Harmless dirt	0.1%	0.1%	0.2%
Specification harmless dirt	Broken seed	Broken seed	Broken seed + dust
Seed of other plant species	0%	0%	0%
Germination			
Standard springs	93%	93%	84%
Fresh non germinated seed	0%	0%	0%
Deformed springs	5%	5%	8%
Dead seed	2%	2%	8%
TGW	39.0 g	39.0 g	28.4 g
Grains under sieve 2.2 mm	trace	0.10%	trace
Grains with awn	14%	14.8%	0.3%
Moisture	1x oat	3x vetch, 1x buckwheat	15.3%

Table 4

Structure of used of cereal seed in organic farming in the Czech Republic (2013)

Species	Growing area (ha)	Seeding rate (kg/ha)	Seed need (t)	Offer of organic seed (t)	Convention untreated seed (t)	Growing area seeded by		
						Organic seed	Convention untreated seed	Farm saved seed
Bread wheat	6,38	220	1,404	181	487	13%	35%	52%
Spelt wheat	2,247	240	539	20	56	4%	10%	86%
Rye	2,392	190	455	23	111	5%	24%	71%
Barley	3,349	200	670	36	378	5%	56%	39%
Oat	5,495	180	989	33	586	3%	59%	38%
Triticale	4,548	190	864	47	390	5%	45%	50%
Buckwheat	717	50	36	19	6	53%	17%	30%
Millet	162	20	3	0	3	0%	100%	0%
Cereals total	25,29	-	3,556	359	2,017	10%	57%	33%
Source: Based on data UZEI (2014) and ÚKZÚZ (2015)								

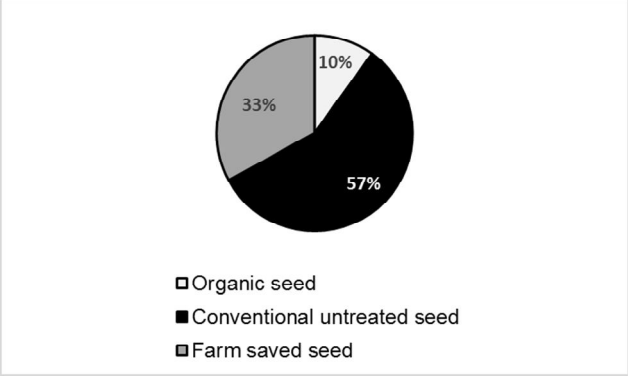

Figure 1 **Share of seed categories used for seeding in 2013 (organic farming)**

Picture 1

Differences in conventional seed treatment

Winter barley „Paso“ – treated by Orius 5 FS 1,2 L/T	Winter wheat „Genius“ – treated by Lamardor 0,2 l/t + Peridiam 1,5 l/t	Winter wheat „Genius“ – treated by Lamardor 0,2 l/t + Peridiam 1,5 l/t

Comparing the demand and offer of the certified organic seeds (see *table 4*), we can see only 10% of the demand for the certified organic seeds being met (see Figure 1). In 2011, ten percent of the certified organic seeds sown in the Czech Republic originated from the Czech Republic (Hůda, 2013). Nowadays, more certified organic seeds are offered in the Czech Republic (+10%). The total area of certified organic fields is, nevertheless, larger (the area is 3,000 ha larger than in 2011). Legislative changes and amendments are necessary for better situation on the organic seed market. The organic seed shortage is partly influenced by exceptions to use of the untreated conventional seeds. It is also caused by a disallowance and unacceptance of parties (it is subject to legislation on seed reproduction). Whole Europe faces such a problem (Groot *et al*., 2004).

CONCLUSIONS

Good-quality seeds are necessary for a good-quality and strong crop stand to be established. Certified seeds guarantee the elementary seed quality. Analysing the certified seeds that were collected from various Czech farmers and farms, we have not identified any serious problems. All the seeds meet the requirements of the Act No. 219/2003 Coll. Offer of the certified organic seeds is very low on the market. We have verified such a fact by our research.

Only 10% of a demand for the certified organic seeds were satisfied between 2011 and 2013. Most of the seeds were conventional untreated (57%) and farm seeds (33%). Since 1990 when the organic farming started to develop, the issue of certified organic seed production and offer has been discussed in the Czech Republic. The problem has not been solved yet. Farmers have been using and exchanging their own material or they buy conventional untreated seeds.

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REFERENCES

Capouchova I., Konvalina P., Stehno Z., Prokinova E., Janovska D., Honsova H., Blaha L., Káš M., 2012 - *Organic cereal seed quality and production*. In: Konvalina, P. (ed), *Organic Farming and Food Production*, Intech, Rijeka, Croatia, pp. 25-45.

Dobiášová B., 2012 - *Informace pro odběratele osiv: Uznávání osiva*. In: Samsonová, P. (ed), Produkce osiv v ekologickém zemědělství: Metodika pro praxi. Bioinstitut, Olomouc, pp. 13-14.

El-Naimi M., Toubia-Rahme H., Mamluk O.F., 2000 - *Organic seed treatment as a substitute for chemical seed-treatment to control common bunt of wheat*. European Journal of Plant Pathology, 106: 433-437.

Groot S.P.C., van der Wolf J.M., Jalink H., Langerak C.J., Bulk R., 2004 - *Challenges for the production of high quality organic seeds*. Seed Testing International, 127: 12-15.

Hosnedl V. 1997 - *Význam podmínek množení a deteriorace semen pro kvalitu osiva*. In: Osivo a sadba, III. národní seminář k polním plodinám. Sborník referátů. ČZU, Praha, pp. 55-62.

Hůda P. 2013 - *Vývoj aktuální situace na trhu s bio osivy v České republice*. [Diplomová práce]. České Budějovice, 76 p.

Moudrý J. Jr., Jelínková Z., Plch R., Moudrý J., Konvalina P., Hyšpler R., 2013 - *The emissions of greenhouse gases produced during growing and processing of wheat products in the Czech Republic*. Journal of Food, Agriculture and Environment, 11: 1133-1136.

Prokinová E., Ondráčková E., Ondřej M., 2015 - *Biologické ošetření osiva obilnin*. In: Pazderů, K. (ed.), Seed and seedlings, ČZU, Praha, pp. 28-34.

Prokinová E., 2011 - *Rizika spojená s výskytem snětivosti klasů pšenice*. Úroda, 59: 60-63.

Prokinová E., 2012 - *Zdravé osivo - základ zdravého porostu*. In: Samsonová P. (ed.), *Produkce osiv v ekologickém zemědělství: Metodika pro praxi.* Olomouc, Bioinstitut, pp.17-20.

Serpolay E., Dawson J.C., Chable V., Lammerts van Bueren E.T., Osman A., Pino S., Silveri D., Goldringer I., 2011 - *Diversity of different farmer and modern wheat varieties cultivated in contrasting organic farming conditions in western Europe and implications for European seed and variety legislation*. Organic Agriculture, 1:127-145.