Quality and Quantity standards for native seeds

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Abstract

The recording of the quality parameters of individual species, respectively, mixtures of various species are, as far as possible, aligned with the methods of the "International Seed Testing Association" (ISTA, 2009). Since there are still no guidelines for the definition of quality criteria for green hay, dry hay, seed stripping and on-site threshing, it was tried to find some methods which are practicable and recommendable. The time of harvesting and the technique used are of considerable significance. Necessary for successful restoration is an especially high content of different seeds in the seed- and plant materials. Finally, the share of mature seeds in the harvested material is decisive for the germination capacity and consequently for the transfer rate on the newly sown area.

Key words: harvesting method, germination capacity, purity, TSW

Introduction

The seed production of plants and the biomass of a meadow stock are dependent on the course of precipitation- and temperature during the year. Thus, harvesting time and harvested volume are dependent on the weather prevailing during the respective vegetation period (Krautzer et al., 2003). Especially with dry- and semidry types of meadows, early harvesting in June means that the percentage share of grasses is higher, while a harvest carried out in July or August increases the share of herbs (Hölzel & Otte, 2003). It would generally be desirable to mix an early and late harvest to cover the greatest possible spectrum of species. Species number and the composition of the harvested material are strongly dependent on the type of meadow. A harvesting date set too early or too late can lead to the disappearance of several plants (Kirmer & Tischew, 2006). With moist or alternating types of one cut meadows, the optimum harvesting time is between middle of August and middle of September. In this respect, it is usually a case of valuable nature-conservation areas, which cannot be mown before a set date. In Austria, for example, it is not permitted to mow litter meadows, which are defined as NATURA 2000 areas, before the beginning of September. The actual number of seeds in green hay (GH), dry hay (DH), seed stripping (SS) or on-site threshing (OST) is dependent on various factors, such as the type of meadow, management ($1^{st}/2^{nd}$ cut), time of day during harvesting, harvesting time in the course of the year, weather conditions and potential seed production.

Table 1: Share of grasses and herbs, harvested volume of pure seeds and length of the harvest (including preparation time) with differing harvesting methods during early harvesting (2009); cleaning and drying not included.

community type	Harvesting method	Harvest time	Grasses : Herbs (%)	Pure seeds (kg/ha)	Duration (h/ha)
Arrhenatherion	Green hay (GH)	End of June	80 : 20	100 - 200	1-2h*

meadow	Dry hay (DH)	End of June	70 : 30	40	3-4h**
	On-site threshing (plot thresher) (OST)	End of June	80 : 20	60 - 150	5-10***
	On-site threshing (large thresher)	End of June	60 : 40	50 - 200	1,5-3***
	Seed stripping (SS)	End of June	80 : 20	20 - 60	1,5-3***
Species rich litter meadows	On-site threshing (plot thresher) (OST)	September	10 : 90	40 - 120	1,5-3***
	Seed stripping (SS)	September	10 : 90	10 - 60	1,5-3***

*depending on technical equipment; **including work processes for the drying of hay; ***depending on vegetation type

Taking samples

When taking samples, a sufficiently large and representative seed sample is to be taken from the entire harvest. Within the sample, every component (pure seeds, undesired species and chaff) should be at the same ratio as found in the batch. The validity of the seed-assessment results is decisively dependent on the care undertaken when taking the sample. The amount of sample taken is according to the entire harvest volume and is defined according to ISTA (2009). Taking samples manually is the most suitable method for seed that flows with difficulty through the seeding device. In this case, it is necessary to open a greater number of sacks and take the first samples manually from differing depths. To acquire samples from the bottom of a sack, it may be necessary to completely or partly empty a certain number of sacks. The containers from which the first samples are taken are to be selected randomly or systematically from the entire batch. The first samples are to be taken from the top, middle and bottom of the containers. If the first samples appear to be uniform, they are then tipped into a clean container and mixed at the end of sample taking. Part samples are gained from repeated halving of the mixed samples. Care must be taken that the seed does not become unmixed through stirring (AGES, 2004; Hebeisen & Graff, 2008; ISTA, 2009).

Purity and thousand-seed weight (TSW) of the seed mixtures harvested on donor sites

The composition and quality of green hay, dry hay, seed stripping or on-site threshing differ greatly from year to year. The share of chaff and impurities, such as earth, can be very high. Stalks and leaves should be roughly cleaned from the dry material before storage and spreading. A sieve with a mesh size of 3-6 mm is recommended for this. If the seed mixture contains larger and bulky seeds, the mesh size of the sieve used is to be according to the size of the largest seed. A homogenous sample, as described above, is taken from the cleaned material. The chaff and seeds are separated in the laboratory and the individual components of the seed mixture defined. This will require 3-6 working days according to the type of meadows. Determination of the purity of the harvested seed- and plant materials is important to ascertain the volume of pure seeds that are contained in the material, which then defines the actual seeding volume of the entire material. For determination of the thousand-seed weight, four times 100 randomly available full seeds are counted and weighed. A homogenous sample is decisive for achieving a uniform result (ISTA, 2009).

Table 2: Purity and TSW of different communities and different harvesting methods

Community type	Harvesting method	Seed : chaff (%)	TSW (g)
Arrhenatherion meadow	Green hay (GH)	10:90	-
	On-site threshing (large thresher)	45:55	-
	On-site threshing (plot thresher) (OST)	60:40	1,04
	Seed stripping (SS)	55:45	0,84
Molinia caerulea rich litter meadow	On-site threshing (plot thresher) (OST)	40:60	1,45
	Seed stripping (SS)	70:30	1,45
Iris sibirica rich litter meadow	On-site threshing (plot thresher) (OST)	40:60	0,94
	Seed stripping (SS)	60:40	1,83

Germinating capacity of seed mixture harvested on donor areas

There is no prescribed method for the determination of the germination capacity of seed mixtures harvested from meadows. Therefore, a method was developed within the scope of the SALVERE project and existing literature for previous successfully applied germination treatments (Heilinger & Florineth, 2003; Molder, 2008; ISTA, 2009; Godefroid et al., 2010) to gain sufficiently valid statements about the seed potential of a harvested donor site within a clear period of time, and with limited technical and personnel expenditure. The seed material was harvested in the year 2009. After determination of the purity, the TSW and pre-tests in the germination chamber (Haslgruebler et al., 2011), the greenhouse trials were implemented and a specific volume (about 3-5 g/m^2 of pure seeds) was sown in four bulb trays on seeding soil. The four samples were counted once a week and divided into monocotyledone and dicotyledone seedlings. The duration of the trial was 4-6 weeks. It was also tested if storage over two years at differing temperatures and the effect of pre-chilling for one week has an influence on the germination capacity. The germination trial was done for an Arrhenatherion and an *Iris sibirica* rich litter meadow.

Results

After the harvested seed material was roughly cleaned the purity was determined. The purity from species rich litter meadows varied depending on the harvesting method. The share of pure seeds for stripped seeds was 65% and for on-site threshings 40%. On Arrhenatherion meadows the content of pure seeds was between 50-60%. The thousand seed weight of harvested seed material varied and depended on the seed size, seed weight and amount of different species in the mixture. The results of the germinations trials on Arrhenatherion meadows showed that pre-chilling, the storage under different conditions and the length of storage had a big influence on the germination capacity. The reason for counting in monocotyledone and dicotyledone was because of the inhomogeneity of the harvested material. The dormancy breaking treatment pre-chilling had a decreasing effect on seeds of Arrhenatherion meadows. Even in the second year showed the variants without pre-chilling a higher germination capacity. The storage under different temperatures had a big influence in the germination capacity. The results displayed that the material stored under cool conditions reveal a higher capacity (over 50%) also in the second year. The samples stored under room temperature achieved results fewer than 50 % germination capacity after the second year.

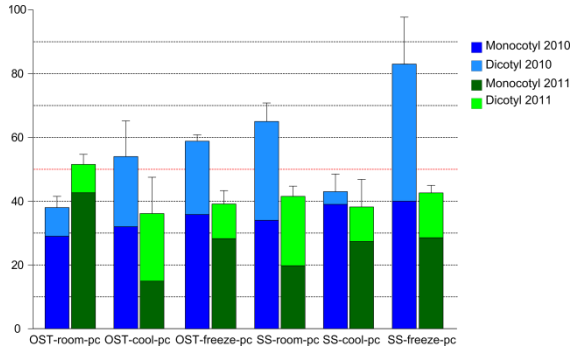


Figure 1: Germination capacity (%) of an Arrhenatherion meadow stored under different temperatures for one (2010) and two (2011) years with dormancy breaking treatment pre-chilling. (Source Blaschka)

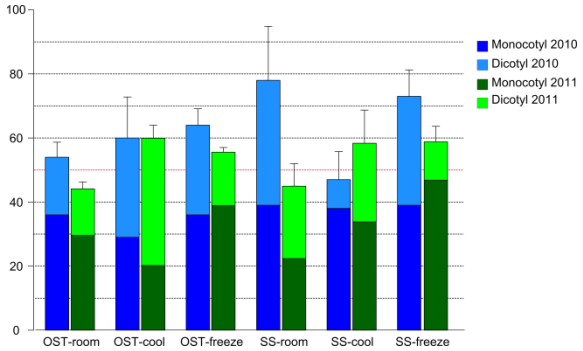
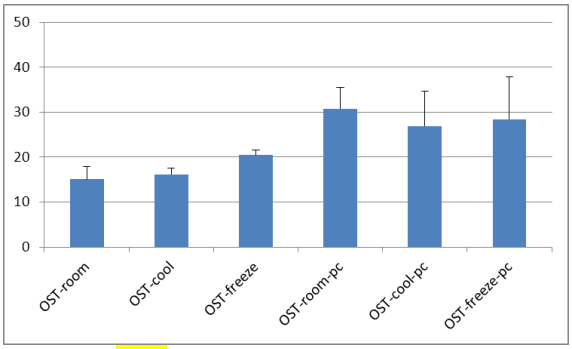


Figure 2: Germination capacity (%) of an Arrhenatherion meadow stored under different temperature for one (2010) and two (2011) years. (Source Blaschka)

The seed material from the *Iris sibirica* rich litter meadow reached a lower germination capacity than the seeds from the Arrhenatherion meadow. The different storage temperatures had no significant influence on the germination capacity but the effect of pre-chilling turned out higher germination capacity on the seeds material from species rich litter meadows.



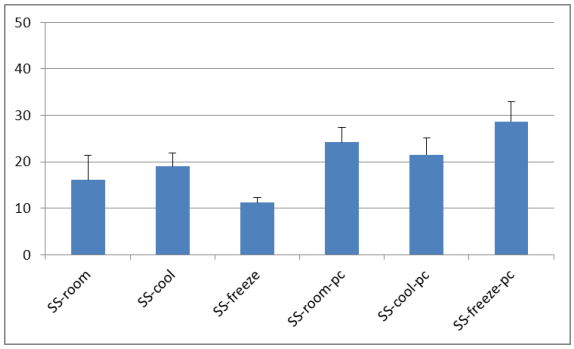


Figure 3-4: Germination capacity (%) of an *Iris sibirica* rich litter meadow stored under different temperature conditions for one year with and without pre-chilling.

Conclusion

The results presented confirm that on-site threshing and seed stripping of potential donor sites are an effective way to harvest seed mixtures for the restoration of semi-natural grasslands. The harvested material contained 40-60% of pure seeds depending on the meadow type. The TSW depends on different facts like seeds size, species composition and so on. If samples have a higher proportion of grasses the germinations capacity is higher. Species rich litter meadows react positively to pre-chilling because most of the species are frost germinators (Graiss et al., 2009) weather seeds from Arrhenatherion meadows show a lower germination capacity. In our germination trial, most of the seeds germinated within the first two weeks, allowing the conclusion that an observation period of four weeks was sufficient. Storage under different temperatures over two years has a big influence on the germination capacity. The storage under cool conditions reveals better results and the

material can be stored longer, at least for two years. By now no quality standards for harvested seed mixtures from semi-natural grassland or species rich litter meadows are defined yet, this was the reason for testing the seed material under different conditions. In fact of the inhomogeneity of the material the results of the trials show that the method which was used is practicable and recognisable. To guarantee a fast vegetation development on receptor sites and a protection against erosion, a minimum germination capacity of 50 % should be used as quality criteria for directly harvested seed mixtures. Another quality criterion could be to guarantee, on not too stony soil, a vegetation cover of at least 60% after a vegetation period on the receptor site.

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