

Acta

Horticulture

Number 355
February 1994



Internationale Society for Horticultural Science

Plant Breeding for Mankind

Symposium Agribex 94



AGRIBEX

Editors
E. Van Bockstaele
J. Heursel



Brussels, Belgium
February 7-8, 1994

"ALKO" THE FIRST SEED-SHATTERING RESISTANT CULTIVAR OF MEADOW FOXTAIL *Alopecurus pratensis L.*

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Summary

Meadow foxtail is a commonly occurring valuable forage grass in European meadow production has been difficult in the past because of heavy seed losses due to shattering at the time of seed maturity. A breeding programme for seed shattering resistance was initiated at the Bayerische Landesanstalt für Pflanzbau Weihenstephan in 1959. Seeds subjected to gamma-irradiation in order to induce seed shattering-resistant mutations of 6300 inbred progenies 38 shattering-resistant individuals were selected. From this material the cultivar "Alko" was created. It was officially registered and released in the Federal Republic of Germany in 1983. Seed of "Alko" has been produced on 64 ha in 1991. "Alko" is included in the Bavarian recommended meadow seed mixture D 3.

1. Introduction

Meadow foxtail, *Alopecurus pratensis L.*, is a common grass species in permanent grassland of Europe. Due to its high persistency and superior winterhardiness it is one of the few forage grasses that grow well in high latitudes such as in Scandinavia. The suitable habitat is a moist and fertile soil and a two-to three times cutting regime. Stebler (1956) found meadow foxtail in 42 % of about 4000 German grassland sites ; 61 % of the meadows and 24 % of the pastures contained this grass. Ever since Stebler and Schmid (1892) and Strecker (1914) praised it, meadow fescue has been regarded as one of the most productive and nutritive forage grasses. Consequently, Klapp et al. (1953) attributed the forage value index 7 out of 8 maximum possible. It is surprising, therefore, that meadow foxtail has been neglected for a long time by both plant breeders and seed merchants. In fact, the first and until 1983 only cultivar in Germany "Wehrdaer Rhön" was selected from permanent grassland in the Freising area, was released and registered in 1955 (Anonymous 1968). Even thereafter seed production of meadow foxtail in Germany remained almost nil. The small quantity of occasionally imported seed was reported as "miscellaneous grasses" (Bundesamt für Ernährung Und Forstwirtschaft).

2. The problem

What are the reasons that almost no seed of this highly esteemed grass has been produced in the past ? Probably the peculiar behaviour of meadow fescue during flowering and seed maturing period is most important. At first there is a considerable genetic variation among plants with regard to the beginning of heading. Secondly, within an individual plant the tillers do not start flowering simultaneously but dur-

extended period of time. In addition, the dehiscence of the florets within a flower head starts subsequently from the bottom to the top for several days. As a result the maturity stages of the ripening seeds are spread over an extensive period of time. The main problem, however, is that the seeds when fully mature do not remain attached to the spikelets but drop to the ground. A heavy loss of seed due to shattering is the consequence, resulting in an unsatisfactory seed yield. Because of an inadequate seed price for the producer there was little incentive for the production of meadow foxtail seed.

3. Breeding for seed-shattering resistance

The difficulties of seed production in mind we initiated a breeding programme at the Bayerische Landessaatzuchtanstalt in Weihenstephan aiming at the creation of a meadow foxtail cultivar which combines high agronomic performance with seed-shattering resistance. Starting in 1959, we treated seeds of our current breeding stock with gamma-rays in the research atomic reactor of the Technical University Munich in Garching. Increasing irradiation intensities i.e. 250, 500, 1000, 2000, 3000, 6000 and 9000 Roentgen units were applied. A total of 15 000 seedlings were transplanted in an observation nursery in 1959, and a total of 9500 plants were selfed in 1960, 1961, and 1962. 6300 I1,-progenies were tested for seed-shattering resistance and 38 superior plants were selected. Each plant was then divided into four clone-plants which were used to arrange a polycross nursery in 1963. I1,-polycross seed was harvested of each of the 38 selected I1,-plants in 1964. The I1,-polycross seed of the 26 highest seed yielding selections were used for the establishment of a polycross progeny test in 1965. They were evaluated for seed-shattering resistance and agronomic performance. According to the results of the progeny test the top seven of the 26 best I1,-plants were selected. Five of these originated from a 2000 Roentgen, one from a 3000 Roentgen, and one from a 250 Roentgen irradiated female parent. A progeny test was conducted with the seven superior selections in 1971 and 1972. In 1973 the material was given to the Bayerische Pflanzenzuchtgeseellschaft. Breeders rights and registration of the new cultivar was applied for in 1978 and granted in 1983. The cultivar was named "Alko".

4. Seed production

Commercial seed production of "Alko" started in 1984, 25 years after the initiation of the breeding programme. In 1993 "Alko" seed was produced on 64 ha (Anonymous, 1993). The average seed yield is 210 kg/ha (Scheller, 1991).

In order to compare the seed-shattering resistance of "Alko" with normal shattering type, and to evaluate the optimum stage of maturity of meadow foxtail for the harvesting of seed, a field experiment was conducted using the cultivar "Lipex" for comparison. There were 10 harvesting dates with 3 days increments from 1 July to 31 July, 1991. The first harvest was taken at stage 75 (Simon and Park, 1983). The results are summarised in table 1. During the first two harvest dates, "Lipex" exceeds "Alko" in seed yield. The maximum seed yield is obtained on July 8 in both cultivars. Any delay of the harvest date results in a subsequent decrease of the seed yield, but the losses are much smaller in "Alko" than in "Lipex". The delay of harvesting from the date of maximum yield, July 8, to July 31 results

in a seed yield decrease of 205 kg/ha or 73% in "Lipex", but of 131 kg/ha or 47% "Alko". At the same time "Alko", whose seed yield equals "Lipex" at the date of maximum yield, becomes increasingly superior to "Lipex" with advancing maturity. Thus, three weeks after the date of maximum harvest, the seed yield of "Alko" is about twice as much compared with that of "Lipex".

Table 1

harvest date	Lipex kg/ha	seed yield	
		Alko kg/ha	% of Lipex
1. July	264	244	92
4.	282	271	96
8.	281	279	99
11.	213	270	127
15.	146	209	143
18.	139	201	145
22.	132	216	164
25.	123	200	163
29.	60	127	212
31.	76	148	195
average	172	217	126
seed loss 8.-31. July			
kg/ha	205	131	
%	73	47	

5. Conclusion and outlook

Evidence clearly demonstrates the success of the breeding programme for resistance to seed-shattering in meadow foxtail. Although the resistance of "Alko" is not complete, the cultivar is much less prone to seed losses. This enables the seed grower to obtain a seed yield which, at the current market price situation, makes it profitable to produce meadow foxtail seed. About 10 000 kg of meadow foxtail seed have been produced annually since 1991. Consequently meadow foxtail could be included in an officially recommended seed mixture. The Bavarian mixture D 3 contains "Alko" at the seed rate of 2 kg/ha.

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