Development of barley cultivars for animal forage in Korea

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Introduction

In Korea, the domestic consumption of barley as a cereal crop has been decreasing since the 1980s. It has been considered that crop production in the winter-season rice fields could enhance the global competitiveness of domestic livestock industry by providing better quality fodder to livestock and enhancing field use rate. Therefore, the purpose of barley cultivation for cereal food production has been recently replaced by the production of the barley for forage use. Consequently, the area of barley cultivation for forage is markedly increasing in Korea. While any type of barley can be used as forage for feeding cattle, whole crop barley delivers a higher dry matter yield than conventional feed barley. This paper described the present state of forage barley cultivars developed in Korea.

Methods

All of the cultivars were developed by the breeding team at National Institute of Crop Science (NICS), Rural Development Administration (RDA) in 2002 to 2012. The cross combinations for F_1 production were as follows: Youngyang, between cultivar Bunong and an elite pedigree Miryang55; Sunwoo, a germplasm line P71523 and a pedigree Suweon234; Sangwon, a germplasm line 72sel and a breeding line SB86659-B-YB-22; Soman, a breeding line SB79124 and SB77189; Wooho, F_1 [Olbori // F_6 (SB77011) / F_5 (Bengei // Hagane / Bunong)] / 3 / (Y7213 / SD607 // CM67 / Miryang12)] and F_1 [(1012.2 / IB65 // Olbori) // (Samheung // Suwon18 / Kangbori)]; Yuyeon, a pedigree Suwon311 and SB86648; Dami, a germplasm line BGS60 and cultivar Kangbori; Younghan, F_1(YB3433-3B-5 / YB3135-3B-2-3) and an elite breeding line YB3135-3B-2-3, Youho, a pedigree Suwon339 and Suwon355; Youhan, a pedigree Milyang100 and an elite an breeding line SB951050-B-B-B-77-0-P-3; and Nokyang, cultivar Nakyoungbori and an elite breeding line SB77368-B-145. After preliminary and advance yield testing for 2 years, the promising lines were subsequently evaluated for earliness (heading date) and forage yield during 3 years in several parts of the country, and each of the cultivars finally named were released to farmers of Korea.

Results

The characteristics of barley cultivars required for whole crop silage are not the same as those required for cereal food. For example high biomass of whole plant including leaves, culms, and grain is more important than grain weight compared to the cultivars grown for food (Sakai *et al.* 2003). We have developed forage barley cultivars with cattle's favourite characters (Choi *et al.* 2007a; Karren *et al.* 1994) such as smooth awn, hooded spike, and auricleless types. Cultivar Yuyeon (Choi *et al.* 2007 a), Youho (unpublished) and Youhan (unpublished) have hood type spike. Cultivar Wooho (Kim *et al.* 2007) and Dami (Park *et al.* 2009) have smooth awn and auricleless type plant, respectively. We also developed rough awn type barley cultivars, such as Yongyang (Park *et al.* 2008), Sunwoo (Park *et al.* 2008), Sangwon (Park *et al.* 2008), Soman (Choi *et al.* 2007 b), Younghan (Park *et al.* 2011), and Nokyang (unpublished), showing early-maturing and high-yielding. They yielded about 12 to 10 t/ha of dry matter yield (average 33 t/ha in fresh matter yield, Table 1), and were evaluated for forage quality which showed a higher silage quality (TDN, ADF, NDF, CP, etc.) for whole crop barley use. Based on these results, it is concluded that barley with smooth awn, hooded, and auricleless could be suitable sources in breeding for whole crop forage use.

Conclusion

We have developed 11 barley cultivars with ruminant-palatable plant characters, such as smooth awn, hooded spike and auricleless, and high biomass as a whole crop as compared with cereal barley. These cultivars have advantages in forage or total digestible nutrients (TDN) yield per unit area. Moreover, it is very economic in land utilization because forage barley is produced in a cropping system following rice during the winter season. The forage barley cultivation requires heavy fertilization to obtain higher yield, it is a break crop, but negatively affects rice grain quality due to increasing protein content. Therefore, improved cultivation technologies are needed to overcome the problem of degrading rice grain quality by residual fertilizer after forage barley cultivation in paddy fields. In the near future, we also plan to develop forage barley cultivars with awn-less,

Table 1. Average agronomic characteristics and forage yield of forage barley cultivars in Korea. Data collected from 4 to 7 different locations for 3 years.

Cultivar	Released year	Heading date	Fresh yield (t/ha)	DM[1] yield (t/ha)	TDN[2] (%)	Characteristics
Olbori	-	April 27	-	9.9	63.0	Cereal barley
Youngyang	2002	May 1	37.5	11.7	65.5	Rough awn
Sunwoo	2002	May 8	36.0	11.0	61.8	Rough awn
Sangwon	2004	April 24	36.0	11.8	63.7	Rough awn
Wooho	2005	April 29	36.1	11.0	65.9	Smooth awn
Yuyeon	2006	April 27	33.5	10.8	66.4	Hooded spike
Soman	2006	April 23	31.7	10.6	67.9	Rough awn
Dami	2007	April 30	32.9	12.0	66.4	Auricleless
Younghan	2008	April 26	33.4	12.0	67.4	Rough awn
Youho	2008	April 24	30.9	11.6	69.2	Hooded spike
Youhan	2012	June 2	36.9	12.6	67.7	Hooded spike
Nokyang	2012	June 4	37.3	11.7	68.5	Rough awn

[1]DM = Dry matter, [2]TDN = Total digestible nutrients. Sowing and harvest were mid-October and the end of May (early yellow stage), respectively.

high biomass and lysine content, good silage quality such as high sugar content, and solid and brittle stem types.

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