Development of *Brassica juncea* as a suitable oilseed crop for cold dry lands

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Abstract

Cold dry lands occupy over three million hectares of arable lands across Iran. Wheat/pasture and wheat/fallow are dominant cropping system in cold drylands and oilseed crops in rotation are not defined. Low fall precipitation and rapidly decreasing temperatures typical to this region often restrict winter planting of any crop except than wheat in rainfed conditions. As a result, development of spring type *Brassica* oilcrops has been a high priority in Dryland Agricultural Research Institute. *Brassica juncea* lines have showed good performance compared to spring type *Brassica napus* cultivars from origin of Canada and Australia. Evaluation of some accessions of Indian mustard from Canada and Pakistan was not successful because of high erucic acid and glucosinolate contents. Hence, our breeding program has been oriented towards the breeding of canola quality cultivars. This presentation will detail the present status of the research and future perspectives of *Brassica juncea* development in cold drylands.

Key words: Canola, Indian mustard, Highlands

Introduction

There is about 5.5 million hectares arable lands in the rainfed condition of Iran. The cold drylands occupy 3 million hectares in the northwest and northeast of the country that receive 220-350 mm precipitation during growing season and cropping system is devoted to wheat/pasture in this region. Total 2 million hectares is devoted to fallow that is not necessary based on the previous researches and may be replaced with suitable alternative crops (Alizadeh, 2003). Oilseed crops in drylands are needed for edible oil production in one hand and towards sustainable agriculture in the other hand. Among oilseed crops, rapeseed, safflower and sunflower are introduced as suitable crops for Iranian rainfed conditions (Rashid, et al. 2002). In order to find suitable *Brassica* oilseed crops for cold drylands, some field trials using genotypes from divers backgrounds have been conducted since 1999 in Dryland Agricultural Research Institute (DARI). Results showed that obligate and facultative winter type cultivars are not adapted to cold drylands of Iran, they couldn't develop to rosette stage that is the most cold tolerance stage in rapeseed and atypically harsh fall and winter temperatures result in subsequent winter injury (Alizadeh, 2003). Rapeseed is suitable for irrigated lands and warm rainfeds of the country which is developing and today some canola quality rapeseed cultivars such as Hyola-401 is cultivated in about hundred thousands hectares. Spring type and drought tolerant *B. juncea* cultivars can be used for reliable oilseed production in the cold drylands (Alizadeh, 2003). However, present Indian mustards such as Bard-1 and Landrace were not double zero and could not be used for oil production in commercial scale because only *Brassica* oilseed cultivars that are low in erucic acid and glucosinolate content are suitable as edible oilseed crops. The potential benefits of developing canola quality *B. juncea* are recognized by some other countries, particularly Canada, Australia and India, where many breeding projects focused on its development (Raney, et al. 2003). This paper will detail the present status of the research and future challenges of *B. juncea* development in cold drylands of Iran.

Materials and Methods

Five *B. juncea* lines viz. DARI-1, DARI-2, DARI-3, DARI-4, DARI-5, nearing canola quality obtained from interspecific crosses along with five *B. napus* cultivars viz. Legacy, Rainbow, Star, Vangard and Westar, were evaluated as spring crop in the northwest (Marageh) and northeast (Shirvan) dryland research stations during three years (2003-2005). The experiments were sown in the late April. Each genotype was grown in plots of 6 rows 5-meter long in a spacing of 20-cm between rows. The mentioned canola quality lines of *B. juncea* were tested also in one hectare of farmer fields at three cold provinces during 2005-2006. Oil percent and fatty acid profile of tested materials was determined in national oil analyzing laboratory at seed and plant improvement institute.

Results and Discussion

Fatty acids profile of *B. juncea* lines and some agronomic traits of all genotypes are summarized in table 1 and 2, respectively. Low glucosinolate (⩽7 μmol/gr) and low erucic acid content (⩽2%) in one hand and relative high oleic acid (>47%) and low linolenic acid (⩽12%) in the other hand, were considerable in new materials.

The selected near canola quality *B. juncea* lines had better performance in comparison to spring type *B. napus* cultivars. All selected lines of *B. juncea* in farmer conditions showed good yields above 1000 kg/ha that was superior in comparison to spring type *B. napus* cultivars with mean 600 kg/ha grain yield. The advantage of shatter resistance in *B. juncea* will assist in developing of canola quality cultivars in cold drylands of the country. Shattering tolerance provide more flexible harvesting time along with saving grain yield in the harvesting.

Release of one canola quality *B. juncea* cultivar and its fully exploit in cold drylands is our first priority and further development of high yielding and high oil cultivars with high mono-unsaturated acid content and lower glucosinolate content are future challenges in Iranian cold drylands.

Table1- fatty acids profile (%) and glucosinolate (µmol/gr) in selected materials of *Brassica juncea*

Accession	$C_{16:0}$	$C_{18:0}$	$C_{18:1}$	$C_{18:2}$	$C_{20:0}$	$C_{18:3}$	$C_{22:1}$	Others	Glucosinolate
DARI-1	5.27	2.44	48.99	30.68	1.22	9.98	1.4	-	6.3
DARI -2	5.11	2.12	47.74	32.33	0.93	10.96	0.33	0.48	2.61
DARI -3	3.79	2.14	47.38	30.98	1.99	11.29	1.77	0.65	6.05
DARI -4	4.13	2.18	48.02	31.42	1.7	10.64	0.99	0.95	5.9
DARI -5	4.22	2.07	46.78	30.03	2.28	11.17	2.16	1.28	1.44

Table 2- Performance of 15 advanced lines in spring seeding trial during three years (2002-2005)

Entry	Accession	Pods per plant	Plant eight(cm)	Days to aturity	Grain Yield (kg/ha)	Oil (%)
1	DARI -1	80	100	118	861	37
2	DARI -2	81	59	119	844	42
3	DARI -3	97	92	119	912	40
4	DARI -4	84	69	119	718	43
5	DARI -5	88	85	121	835	38
6	Rainbow	68	40	128	150	39
7	Legacy	72	61	119	662	42
8	Vangard	77	56	128	326	41
9	Star	69	35	128	169	42
10	Westar	45	32	105	73	41

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