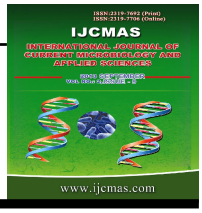
Int.J.Curr.Microbiol.App.Sci (2013) 2(9): 133-140

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 2 Number 9 (2013) pp. 133-140**
http://www.ijcmas.com



Original Research Article

Agronomic and Morphological Characters of Newly Registered Peksen and Reyhan Vegetable Cowpea Cultivars in Turkey

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Keywords

Cultivar; Vegetable cowpea; *Vigna unguiculata;* Agronomic and Morpho-logical Characters

A B S T R A C T

The aim of this study is to introduce of registered vegetable cowpea cultivars Peksen and Reyhan and to reveal their important agronomic and morphological characters. A breeding program on vegetable cowpea was started at Agricultural Faculty, The University of Ondokuz Mayis, Samsun, Turkey in 1997. During this breeding program, 12 advanced cowpea lines were developed from 27 local cowpea populations of Turkey. In the result of breeding programs and subsequent two location yield experiments during 2005 and 2006, two promising lines were selected as candidates for cultivar registration. They were registered as the first vegetable cowpea cultivars with the name of Peksen and Reyhan in April 15, 2011 by the Turkey Variety Registration and Seed Certification Centre (VRSCC). In this article, detailed information with respect to agronomic and morphological characters of Peksen and Reyhan cultivars having fresh pod yield of 108.16 and 67.39 g plant^{-1}, respectively was given. New vegetable cowpea cultivars are recommended due to both high fresh pod yield and having desirable pod characteristics by consumers and producers in vegetable cultivation.

Introduction

Drought tolerance, short growing period and versatile usage of cowpea make it a very attractive alternative for many farmers in dry land areas where drought is the principal constraint of crop production and malnutrition is also major problem for human (Hallensleben *et al.,* 2009). Cowpea is primarily grown in drier regions of the world where it is one of the most drought-resistant food legumes (Dadson *et al.*, 2005). It is usually better adapted to drought, high temperatures and other biotic stresses than other crop plant species (Ehlers and Hall, 1997; Martins *et al.*, 2003; Hall, 2004).

Leaves, immature pods, fresh seeds and dry grains of cowpea can be consumed and marketed as human food (Kebe and Sembene, 2011). Cowpea grains as well as the fresh pods take place among major nutritional contributors to diets for people

in developing countries as cheap protein source.

Early maturing grain type cowpea varieties have short pods with more number of seeds, while vegetable type varieties are grown for their immature long succulent pods with less number of seeds and maturing late and the pods remaining tender and soft for longer period (Umaharan *et al.,* 1997; Pandey *et al.,* 2006).

Vegetable cowpea production of Turkey in 2012 was 20566 tons. Samsun province of the Black Sea Region is one of the leading cities of Turkey regarding sowing area and production of many vegetables (TUIK, 2012). Besides cowpea is not originate in Turkey, it is traditionally grown in Aegean and Mediterranean regions of Turkey for both dry seeds and immature pods. It is also grown by small-scale farmers just for their requirements in the Middle Black Sea Region (Peksen *et al.,* 2000). Recently, researches on dry and vegetable cowpea are increased in Black Sea Region (Peksen *et al.,* 2000; Peksen *et al.,* 2002; Ozturan and Gulumser, 2004; Peksen, 2004; Peksen and Artik, 2004; Peksen *et al.,* 2004; Peksen *et al.,* 2005; Peksen, 2007; Bozoglu and Peksen, 2009; Peksen and Peksen, 2012).

Variety registration process following 16 years cowpea breeding program carried out at Ondokuz Mayis University, Faculty of Agriculture and the releasing of vegetable cowpea cultivars Peksen and Reyhan were completed in 2011 by the Turkey Variety Registration and Seed Certification Centre (VRSCC). However, there was no detailed report with respect to agronomic and morphological characters of these new and the first vegetable cultivars of Turkey.

The subject of this study was to introduce agronomic and morphological characteristics of new cultivars that have potential to be an alternative agricultural crop for the Black Sea Region and also improve cowpea production in Turkey.

Materials and Methods

Collection of cowpea seed material and breeding program

A breeding program on cowpea has been started in 1997 at The University of Ondokuz Mayis, Faculty of Agriculture in Samsun, Turkey with the aim of developing vegetable cowpea cultivar/s. At the beginning of breeding program, collected seeds of 27 local cowpea populations currently grown in Aegean and Mediterranean regions of Turkey were separated into sub samples according to collection site, seed shape and also seed or hilum colors. Some promising lines that would be new cultivar candidates have been selected from these local cowpea populations by a single plant selection method between 1997 and 2004. All lines were evaluated for agronomic, morphological and phenological characters and fresh pod yield.

Site and experimental layout description

Total of 12 vegetable cowpea lines selected for some plant characteristics and fresh pod yield from among hundret of breeding lines were compared with existing Akkiz-86 and Karagoz-86 control cultivars in two field experiments conducted at the Research Station of Faculty of Agriculture, Ondokuz Mayis University of Samsun (41° 17' N latitude, 36° 19' E longitude, 150 m asl) and Black Sea Agricultural Research Institute

Ambarkopru Research Station (41°21' N latitude, 36° 15' E longitude, 4 m asl), Carsamba, Turkey, in 2005 and 2006 (Peksen and Peksen, 2012). Regional yield experiments were arranged in Completely Randomized Block Design with four replications. Distance between and within rows was 60x10 cm. Two promising lines from these two years regional yield experiments were presented for cultivar registration to VRSCC in 2007. Registration experiments were conducted at Samsun and Cayirova in field condition and under glasshouse conditions in Ankara during 2008 and 2010 by VRSCC.

Morphological and phenological characteristics

IBPGR and UPOV descriptors for *Vigna unguiculata* (L.) Walp were considered to clasify morphological and phenological characteristics during both single plant selection process throughout breeding program and regional yield experiments (IBPGR, 1983; UPOV, 2009). In this paper, comprehensive data on agronomic, morphological and phenological characters of cvs Peksen and Reyhan have been complied from vegetable cowpea breeding studies and regional yield experiments in recent 10 years.

Results and Discussion

Morphological characters

Traditionally grown vegetable cowpeas were in the form of local or mixed population as it is currently. When vegetable cowpea breeding program completed in 2004, two promising cowpea lines were developed. Application process for registration of these two lines started in 2007. At the end of the registration trials, two lines were registered in the name of Peksen and Reyhan as the first vegetable cowpea cultivars of Turkey by VRSCC in 2011. There was no existing vegetable cowpea cultivar until 2011 year that Peksen and Reyhan were registered. Morphological characters of these cultivars based on IBPGR (1983) and UPOV (2009) descriptors for cowpea are presented in Table 1.

In vegetable cowpea production, growers tend to prefer climbing tall cultivars since they give higher fresh pod yield when compared to bush types. Farmers prefer green pod color, long pods with tender and stringless for home consumption (Pandey *et al.,* 2006). Both cultivars have indeterminate growth pattern. Peksen is a climbing type, while Reyhan is intermediate which most of lower branches touched the ground (Table 1 and Figure 1).

Flower colors of Akkiz-86 and Karagoz-86 are white. Peksen has purple flowers, while Reyhan has yellow in back side of standard and cream in front side, wing with purple pigmented upper margin. Peksen and Reyhan have evident differences from Karagoz-86 and Akkiz-86 cultivars for seed characteristics. The most distinctive trait of Peksen seed is that it has completely black seed coat when compare with white and cream seeded Karagoz-86 and Akkiz-86 cultivars developed for mainly dry seed, respectively. Reyhan has speckled and mottled half black and half white eye color while Peksen has no eye. Kidney-shaped seeds of Peksen and Reyhan have smooth and smooth to rough testa texture, respectively (Table 1 and Figure 1).

Phenological and agronomic characters

Descriptive statistics such as mean,

Table.1 Morphological characters of Peksen and Reyhan cultivars based on IBPGR (1983) and UPOV (2009) descriptors for cowpea

Characters	**Cultivars**	
	Peksen	**Reyhan**
Growth habit	Climbing	Intermediate (most lower branches touch the ground)
Growth pattern	Indeterminate	Indeterminate
Twinning tendency	Intermediate	Pronounced
Plant pigmentation	Moderate at the base and tips of petioles	Moderate at the base and tips of petioles
Intensity of leaf green color	Medium	Dark
Terminal leaflet shape	Hastate	Deltoid
Presence V-mark on leaflets	Absent	Absent
Hairiness of stem, leaves and pods	Glabrescent	Glabrescent
Flowering pigment pattern	Completely pigmented	Wing pigmented, standard with light V-shaped pattern of pigment at top center
Flower color	Purple	Back side of standard is yellow and front side is cream, wing with purple pigmented upper margin
Raceme position	Throughout canopy	Mostly above canopy
Pod attachment to peduncle	Pendant	$30 – 90^{o}$ down from erect
Immature pod pigmentation	Pigmented tip	Pigmented tip and whole pod
Pod curvature	Slightly curved	Straight
Pod color	Light green	Dark green
Stringiness	Absent	Absent
Pod twisting	Absent	Absent
Seed shape	Kidney-shaped	Kidney-shaped
Testa texture	Smooth	Smooth to rough
Attachment of testa	Testa firmly attached to seed	Testa firmly attached to seed
Main seed color	Black	White
Presence of secondary seed color	Absent	Black
Pattern of secondary seed color	Absent	mottled on part of seed
Eye pattern	Absent	Holstein group
Eye color	Eye absent	Speckled and mottled half black and half white

Table.2 Descriptive statistics for phenological and agronomic characters of Peksen and Reyhan cowpea cultivars

Characters	Cultivars			
	Peksen		Reyhan	
	Mean ± SEM[a]	Min-Max	Mean ± SEM	Min-Max
Days to first flowering (days)	54.60±1.44	47-61	53.40±1.77	45-61
Days to first podding (days)	58.10±1.39	50-64	56.80±1.69	48-64
Plant height (cm)	124.13±12.38	76.80-187.30	101.68±13.92	46.20-179.50
Pod number (pods plant^{-1})	11.02±3.50	3.80-33.40	18.43±3.58	5.30-38.60
Pod length (cm)	32.33±0.71	29.06-36.04	15.34±0.43	11.71-16.43
Pod width (mm)	7.05±0.09	6.58-7.50	5.93±0.09	5.35-6.34
Pod thickness (mm)	6.12±0.08	5.60-6.66	5.43±0.08	4.99-5.89
Pod flesh thickness (mm)	1.27±0.06	0.98-1.63	1.24±0.04	1.05-1.49
Seed length (mm)	9.61±0.09	7.4-11.5	7.52±0.09	6.00-9.75
Seed width (mm)	6.16±0.05	4.4-7.1	5.62±0.05	4.52-6.72
Seed thickness (mm)	4.09±0.03	3.25-4.92	4.62±0.04	3.63-5.51
100 seed weight (g)	8.10±0.08	7.84-8.46	7.20±0.12	6.74-7.68
Fresh pod yield (g plant^{-1})	108.16±38.93	25.08-358.75	67.39±14.22	19.60-163.64

[a]SEM: Std. Error of Mean

Figure.1 Leaves, flowers, pods and seeds of cowpea cultivars Peksen (on the left) and Reyhan (on the right), and overview of plants at generative growth stage

extreme values, standard error of mean were calculated for some plant characters of new vegetable cowpea cultivars are presented in Table 2. Days to first flowering (DFF) and first podding (DFP) of both cultivars are very close (Table 2), but DFF and DFT may show differences due to the sowing time, growing environment and cultivation practices.

Peksen and Reyhan have desirable pod characteristics for vegetable cowpea production. Fresh pods of Peksen are in 29.06-36.04 cm length, light green, stringless and unique appearance and delicate flavor. Reyhan has pods in 11.71-16.43 cm length, dark green, stringless and delicate flavor. In Reyhan, harvesting of fresh pods on time has quite importance as its pods can be stringy when they harvested in a little bit late time. In contrast, fresh pod harvesting time in Peksen for each subsequent harvest is more flexible when compared with Reyhan.

Fresh pod yields per plant of Peksen and Reyhan cultivars were determined as 108.16 and 67.39 g plant^{-1}, respectively (Table 2). Peksen and Peksen (2012) reported that fresh pod yields per plant of Karagoz-86 and Akkiz-86 cowpea cultivars were 61.37 and 44.82 g plant^{-1}.

Although number of pods per plant of Peksen is low, it has high fresh pod yield due to high pod weight and long pods (Table 2). Peksen (2004) found that fresh pod yield per plant was positively and highly significantly correlated with fresh pod harvest period, number of pods per plant, average pod weight, pod length and pod width. Pod length was found as one of the major factors affecting pod yield in vegetable cowpea (Kar *et al.,* 1995).

Five cowpea cultivars are currently available in Turkey except for Peksen and Reyhan, four developed for dry seeds and one for fodder crop, with the name of Karagoz-86, Akkiz-86, Amazon, Sirma and Ulkem, respectively (VRSCC, 2013). Studies carried out to evaluate the grain yield potential and adaptation ability of cowpea to Black Sea Region of Turkey revealed that cowpea exhibited good plant growth and gave high fresh pod yield in this region. Cowpea may be a good alternative vegetable crop due to its drought tolerance that can make it more competitive when compared to vegetable bean and other crops under drought or heat stress conditions (Peksen and Peksen, 2012). The price of per kg fresh cowpea pods was two times higher than that of both vegetable bean and most of other vegetables in local markets in 2012 summer period. Therefore, it looks like so promising agricultural crops for the vegetable growers of Black Sea Region of Turkey.

It was concluded that newly registered Peksen and Reyhan vegetable cowpea cultivars having a high potential for fresh pod yield could be a good alternative vegetable crop and these can be successfully grown in Black Sea Region of Turkey as much as that in Aegean and Mediterranean regions. Further comprehensive and comparative studies would be helpful to reveal possible position or actual potential of vegetable cowpea against to currently grown vegetables in Black Sea Region of Turkey.

Acknowledgement

The authors wish to thank the Unit of Scientific Research Projects of Ondokuz Mayis University, Samsun, Turkey due to valuable support for the project Z-399 and Z-503.

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