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Full Length Research Paper

“Jumbo 2010”, cultivar of chickpea “kabuli” type of extra large size from Sinaloa, Mexico

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Chickpea (*Cicer arietinum* L.) produced in Mexico is “kabuli” type with white grain, and pronounced rugosity. It is used for human consumption covering the niches in Europe and the Middle East. Mexico is one of the main chickpea exporters due to the production of cultivars with such characteristics which have made them to be recognized as “Mexican” type chickpeas. “Jumbo 2010” is a chickpea cultivar of white grain generated by INIFAP, product of the simple cross “Dwelley” x “Blanco Sinaloa-92”. The leaf is compound, with large, oval, and semi-opaque leaflets. The flower is white, and the pod is large (25-30mm), and green color with medium intensity during the grain-filling period. The grain has caliber 34-36 seeds/30 g of weight, and it is the cultivar with the largest grain size released in Mexico. It presents 97% average of quality export grain, as it passes through a 9 mm diameter sieve. The grain is whitish cream, with pronounced rugosity, and angular shaped. Cooking time is rather similar to “Blanco Sinaloa-92” (between 35 and 40 min, after wetting the grain for 12 h). In the central region of Sinaloa Mexico, during the last five years “Jumbo 2010” has shown an average grain yield of 2,400 kg/ha for export, overcoming with 200 kg/ha “Blanco Sinaloa-92” the cultivar with the highest area sown.

Keywords: *Cicer arietinum* L., export caliber, Blanco Sinaloa-92

INTRODUCTION

Chickpea is classified mainly in two types based on its size, morphology, color, and end use. The “desi” is characterized for its small size (<7mm), angular shape, and diverse color, while the “kabuli” type is larger, beige color, and rugose. The first one is utilized mainly to elaborate flour and balanced feed, while the “kabuli” chickpea is used directly in the kitchen for human consumption in a variety of meals (Sánchez, 2012). Consumers prefer large grain-seed in various meals and salads. Cultivars of “kabuli” chickpeas have three times greater value in the international market than the “desi” types. In the European market, three groups of chickpeas are recognized by the seed diameter: large (> 9mm), medium (8-9mm), and small (<8mm). Chickpeas with seed size greater than 9mm have an overprice of US\$50 dollars per ton (Gowda *et al.*, 2011). There are several nomenclatures for commercialization: “onzaespañola” is equivalent to the number of grains contained in 30g after passing a 9mm sieve. This same measure is utilized in Mexico to determine caliber 40-44 export standard for “Mexican” chickpeas. From 1995 to 2013, Mexican chickpea exports registered an annual average of 100,000 ton mainly for Spain, Argelia, Italy, Turkey, and Portugal (Palau, 2014; SIAP, 2014). “Blanco Sinaloa-92” is the chickpea cultivar most grown in Mexico. It has the desired grain size (caliber 40-44 seeds/30g), cream colored and pronounced rugosity, characteristics highly appreciated in the international market.

As a result of the genetic breeding program by the National Institute for Forestry, Agriculture, and Livestock Research (INIFAP) in Mexico, with the objective to generate “kabuli” type chickpea cultivars with export characteristics, it was proposed the release of experimental line “HOGA-508” as commercial cultivar “Jumbo 2010”.

MATERIALS AND METHODS

Origin, selection, and validation

“Jumbo 2010” is a chickpea cultivar “kabuli” type, originated from the simple cross “Dwelley” x “Blanco Sinaloa-92”. “Dwelley” is a commercial cultivar with light cream grain, developed in Washington State, USA (Muehlbauer *et al.*, 1998), and “Blanco Sinaloa-92” is a commercial cultivar released by INIFAP in the Culiacan Valley Experimental Station (Gómez, 2003). From the first segregating generation (F2) it was harvested in bulk (B), selecting by seed size (large) up to the fourth generation. Individual selection was applied in the fifth generation (F5), which corresponded to plant No. 54 in the locality of Hermosillo Sonora, Mexico (54H). Bulk selection was carried out in

generations F6 and F7, selecting for uniformity in plant characteristics and grain caliber (Muehlbauer and Singh, 1987). The selection history is IIGH.95.1-M-M-M-M-54H-M-M (Manjarrez *et al.*, 2010).

From crop cycle fall-winter (F-W) 2005-2006 up to F-W 2008-2009, “Jumbo 2010” was evaluated in the regional yield trial under the code “HOGA-508”, and later in validation plots in six localities in the states of Sonora, Sinaloa, and South Baja California, Mexico. “Jumbo 2010” has shown adaptation to the Culiacan Valley, Sinaloa, therefore, its registration was proposed specially for this area, although it can adapt to other chickpea-producing areas.

The most important phenotypic descriptors which identify cultivar “Jumbo 2010” were recorded according to the descriptors of the International Union for the Protection of New Varieties of Plants (UPOV, 2005).

RESULTS AND DISCUSSION

Plant characteristics

The characteristics that identify “Jumbo 2010” are shown in Table 1, according to the descriptors of UPOV (International Union for the Protection of New Varieties of Plants).

“Jumbo 2010” plants produce stems of semi-erect habit, slightly more bent (IBPGR-ICRISAT-ICARDA, 1993) than cultivar “Blanco Sinaloa-92”. Foliage is dark green and the leaf is compound with oval, large, green semi-opaque leaflets. The flower is white, and the pod is large (average 28 x 15 mm) (Figures 1 y 2).

Ramification, flowering, and grain

In most cropping species phenological development is controlled by either temperature, photoperiod, or a combination of the two (Verghis *et al.*, 1999). Growth habit is indeterminate as all local chickpea cultivars. It gives rise to branches 64 cm long, with an average of three primary branches and eight secondary ones (Figure 4). Branching density and pattern is a key yield-component trait, as increasing shoot branching can be translated into increase biomass and seed/pod production. Shoot branching plays a key role in adaptation of plant to their local environment by changing the shape of plant. The number and size of the branches formed determine the total area of the plant and the spatial distribution of leaf area in the canopy. The amount of light absorbed by leaves of the plants make them compete with the neighboring plants in terms of light interception and capturing of other resources, thereby

Table 1. Descriptors of chickpea cultivar “Jumbo 2010” (*Cicer arietinum* L.)

Estructure	Characteristic	Description
Plant	Ramification	Strong
Plant	Height	Medium
Stem	Anthocyanin coloration	Absent
Stem	Height of insertion of the first flower	Medium
Foliage	Intensity of green color	Medium
Leaf	Type	Compound
Leaflet	Size	Large
Leaf	Shape	Oval-medium
Flower	Color	White
Peduncle	Length	Medium
Pod	Size	Very large
Pod	Intensity of green color	Medium
Pod profile*	Curve	Highly pronounced
Time of dryseed	Maturity	Medium
Grain	color	Milky white
Grain	Size	Extra large

*J.I. Cubero, 1987.

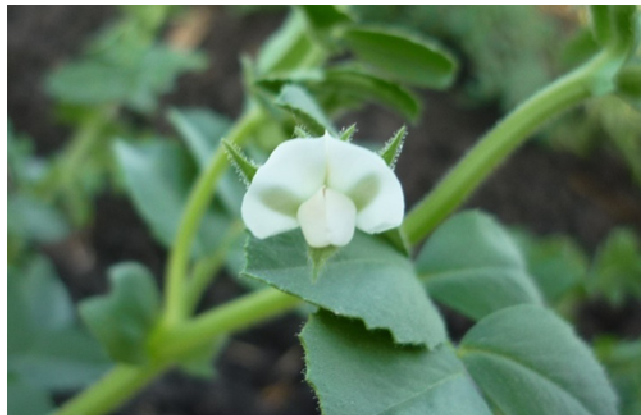


Figure 1. “Jumbo 2010”, shape and color of chickpea leaf and flower.



Figure 2. "Jumbo 2010", pod morphology and color.



Figure 3. Vegetative stage of cultivar "Jumbo 2010" showing the maximum ramification.

reducing the chances of weed growth (Bajaj *et al.*, 2016). Branching exerts its impact on dry matter accumulation and assimilates partitioning into the vegetative compartment and the reproductive growth (Huyghe, 1998).

"Jumbo 2010" produces the first flowers between 39 and 45 days after sowing (das); the flowering stage ends 90 das (average), and maturity to cutting fluctuates between 110 to 120 days, while maturity to harvest between 126 and 135 days. The grain is white and has a pronounced rugosity, similar to that of "Blanco Sinaloa-92". The grain shape is

angular similar to that of "Jamu-96", although this is larger (Figure 3).

Grain yield and caliber

The average grain yield of "Jumbo 2010" from all the regional trials in Culiacan Valley was 2,400 kg/ha as compared to 2,336 kg/ha of "Blanco Sinaloa-92" during the four crop cycles of evaluation (Table 2). "Jumbo 2010" has a larger grain and consequently a greater percentage of



Figure 4. Grain of “Jumbo 2010” showing extralarge size and milky white color.

Table 2. grain yield (kg/ha) of cultivars “Jumbo 2010” and “Blanco Sinaloa 92” established in the regional trial at the Experimental Station in Culiacan Valley, during crop cycles fall-winter 2007-2008, 2008-2009, 2010-2011, and 2011-2012.

Cultivar	Crop cycle				Mean
	2007-08	2008-09	2010-11	2011-12	
Jumbo 2010	3,658	2,375	2,081	1,486	2,400
Blanco Sinaloa 92	2,922	2,572	2,434	1,418	2,336

Table 3. Percentage of grain for export of cultivars “Jumbo 2010” and “Blanco Sinaloa 92” established in the regional yield trial at the Experimental Station in Culiacan Valley, during crop cycles fall-winter 2007-2008, 2008-2009, 2010-2011, and 2011-2012.

Cultivar	Cropcycle				Mean
	2007-08	2008-09	2010-11	2011-12	
Jumbo 2010	98	96	96	97	96
Blanco Sinaloa 92	96	91	94	95	94

Table 4. Grain caliber(seeds/30 g) of cultivars “Jumbo 2010” and “Blanco Sinaloa 92” established in the regional yield trial at the Experimental Station in Culiacan Valley, during crop cycles fall-winter 2007-2008, 2008-2009, 2010-2011, and 2011-2012.

Cultivard	Crop cycle				Mean
	2007-08	2008-09	2010-11	2011-12	
Jumbo 2010	34	36	35	36	35
Blanco Sinaloa 92	42	41	45	40	42

exportable grain which ranges from 96 to 98%. The average grain weight of “Jumbo 2010” is 83-88 g/100 seeds, equivalent to a caliber of 34-36 seeds/30 g of weight. Up to now, none of the white chickpea cultivars released in northwestern Mexico has this grain caliber with

an average of 35 and 96 to 98% vs. 94-95% of exportable grain of “Blanco sinaloa-92” which has an average caliber of 42 (Tables 3 and 4).

Agronomic management

The agronomic management of “Jumbo 2010” is similar to that of “Blanco Sinaloa-9 2” (Gómez *et al.*, 2003) which is the most grown cultivar in Mexico. Soils with high incidence of root diseases should be avoided, since this cultivar has a slightly less resistance to the attack of fungi like *Fusarium oxysporum* f. sp. *ciceris* and *Fusarium solani*. Since its stems are semi-erect and depending upon the environment, harvest will have to be accomplished in three steps (cutting, swath, and harvest).

The registration number in the Mexican National Catalogue of Plant Cultivars (CNVV) of the National Seed Inspection and Certification Service (SNICS) is GRZ-003-100910 (SAGARPA, 2016). Cultivar “Jumbo 2010” is protected under the breeder’s rights and the registration No. 1089 issued by the Mexican Department of Agriculture, Livestock, Rural Development, Fishery, and Food (SAGARPA) since the year 2013.

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