**INTRODUCTION**

Quinoa has been recognized as a climate resilient crop of great value and there is an increasing effort to introduce it in different marginal agriculture production systems of the world. Various quinoa cultivars have been screened for tolerance to abiotic stresses, especially salinity, drought, and frost and the positive attributes of the crop have created wider global interest in its cultivation (Jacobsen, 2003; Jacobson et al., 2003). Quinoa is also considered as strategic food security crop by FAO due to its high nutritional value and to its adaptability to unfavorable growing conditions (Benhalib, Atifi et al., 2004).

Worldwide, the demand for quinoa is growing, especially in the health food segment, but current supplies are unable to match it. Besides the use for human consumption, quinoa seed has other uses as livestock and poultry feed. The whole plant can be used as green fodder and harvest residues can be fed to the animals. (Choukr-Allah et al., 2015).

Quinoa has been introduced for the first time in 2000 to Khenifra region in Morocco to improve the human diet and farmer income in a mountainous region. Selection efforts have been deployed to adapt quinoa genotypes to local environments (Jacobsen and Stolen, 1993). Rhamna area’s minimal temperatures ranged from 4.3 to 5.1 °C, and maximal temperatures from 37.5 to 39.3 °C. Its average annual rainfall is 250 mm/year. Therefore, the present study was conducted with the following objective: characterize five selected varieties from ICBA through phenologic, morphologic and agronomic traits and evaluate their potential of productivity under several environmental plots under rainfed and irrigated conditions.

**MATERIALS AND METHODS**

The experiment was carried out between 18 February and 30 June 2016, in seven trials at Boucane community, Morocco, five were conducted in rainfed and two with irrigation, once a week.

The half of the two trials conducted with irrigation, had been supplied by organic matter at a dose of 40 kg/ha at the sowing.

Five quinoa varieties developed at the ICBA Dubai breeding program were used: Q1, Q2, Q3, Q4 and Q5 more the control which is the local variety of the region Rhamna.

Experimental units (4.5 m²) were organized in a completely randomized block with six replicates. Elementary plots consisted of 3 rows of 5 meter at 1.5 m row-spacing.

The weed control in the parcels is done by hand cutting and picking. Harvests by hand in the end of June were done at physiological maturity. The maturation period, plant height and seed yield were determined for the cultivars that came to harvest stage. Collected data were subjected to analysis of variance; means comparisons were handled using the LSD test at 0.05 significance. Statistical data processing was achieved by the software SPSS, version 12.

**RESULTS**

Quinoa (Chenopodium quinoa) yield potential in the semi arid region of Rhamna, Morocco under rainfed and irrigated conditions

**1. Seed yield**

The analysis of the variance showed significant variation among trials for seed yield (Fig.1).

Q2 recorded high values of seed yield under the three trials (9 q/ha) on rainfed, (36 q/ha) with irrigation with OM and (29q/ha) with irrigation without OM. However, Q4 was the lowest yielding under the three trials too (5.1q/ha, 16.9q/ha) and (15.5q/ha). The control variety, used by the farmers since five years ago, gave also the lowest yield in rainfed and irrigated conditions in comparative with the tested varieties (8.5q/ha, 10.4q/ha and 5.4q/ha).

The results obtained indicated that irrigation combined with organic matter at a dose of 40kg/ha at the sowing, increased seed yield by 500% for Q4, by 400% for Q1 and Q2, by 180% for the control in comparison with the rainfed conditions. Also, the irrigation without organic matter improved the seed yield of all varieties by 322%, 241%, 302%, 431% and 159% for Q2, Q3, Q4, Q5, and the control respectively in comparison with the rainfed conditions. According to statistical analysis, differences are significative for the three effects varieties, irrigation and organic matter.

**2. Pheno-morphological characterization**

There was 27 difference in the maturity between the quinoa varieties on rainfed conditions, and 35 days difference under irrigated conditions with organic matter. Also, variations were revealed for the plant height, which varied significantly from 52cm to 131cm for Q2 under rainfed and irrigated conditions with organic matter and from 42cm to 79cm for the control under irrigated and rainfed conditions.

Grain yield fluctuated between 2.89 and 6 GPlant-1 in Q4 and the local variety respectively under rainfed; and ranged from 10 GPlant-1 in the control to 19.21 in Q2 under irrigated conditions.

**CONCLUSION**

The data analysis highlighted significant yield variation among the tested varieties and trials. The best accession Q2 presented the highest yield at the three locations; it has reached 9q/ha in rainfed conditions, 36q/ha in irrigation with OM. Q3 recorded also the highest yield (32q/ha). Both Q1 and Q2 accessions were intermediate in both their yields. Q4 accession was the least in terms of yield. Highest yield of all accessions confounded was obtained with irrigation with Organic matter, which improves yield potential. Q2 is the best variety to introduce to Rhamna region.