Quinoa: Prospects as an Alternative Crop for Salt-Affected Areas

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Introduction

Salinity and water stress are becoming major constraints to agricultural productivity in the arid and semi-arid regions. In the Arabian Peninsula, where most countries depend almost entirely on groundwater to irrigate crops, large-scale extraction has increased the salinity of the ground water substantially in many areas due to seawater intrusion making it unsuitable for cultivation of the traditionally grown crops. In this scenario, identification and introduction of salt-tolerant alternative crops such as quinoa (*Chenopodium quinoa* Willd.) became crucial to sustain agricultural production.

Figure 1. A salt-affected farm in the UAE

Figure 2. Quinoa (Ames 13761) growing in the salt-affected farm in Ghayathi, UAE

Materials and Methods

The study was conducted during the croping season (November 2012-March 2013) in a farm located near Ghayathi (N 23°42′49.9″, E 52° 54′10.6″) in the Western Region of Abu Dhabi and included three genotypes (Ames 13761, NSL 106398 and NSL 106399), selected for their superior performance in field trials at ICBA's research station. The plot size sown to each genotype was about 5 x 25 m. The distance between rows and between plants was 50 and 25 cm, respectively. Organic fertilizer (manure) was applied at the rate of 4 kg/m2 before sowing, but no other fertilizer was used during crop growth. The plots were irrigated with drip system twice a day for 15-20 min, the flow rate from each emitter being 4-5 l/hr. All the genotypes were harvested 120 days after sowing.

Results and Discussion

Soil and water analysis before sowing showed the quality to be rather poor to support the production of the common forages and vegetables (Table 1 & Figure 1). Nevertheless, germination, plant establishment and growth were found to be good in all the three genotypes of quinoa (see Figure 2). The mean biomass and seed yields, based on three randomly selected 1 m2 areas within each plot are presented in Figure 3. The seed yields from the current studies were much higher than the average yields of 456 g/m2 obtained from ICBA's research station in Dubai [1] and they are on par with the maximum yields (4.0-7.7 t/ha) reported from Kenya and Chile [2,3]. The dry biomass yields obtained here are close to the average yields (8.8. t/ha) reported from Denmark [4].

Table 1. Soil and water analysis data of the farm used for growing quinoa

Variable	Unit	Normal range	Soil (60 cm depth)		Irrigation water	
			Before planting	After harvest	Before planting	After harvest
Sodium (Na^+)	Meq/l	0 – 40	157.61	128.22	102.6	106.09
Chloride (Cl^-)	Meq/l	0 – 30	168.25	126.61	121.5	107.0
Calcium (Ca^{+2}) + Magnesium (Mg^{+2})	Meq/l	0 – 25	65.82	46.22	38.96	46.44
Sulfate (SO_4^{-2})	Meq/l	0 – 20	0.31	–	0.13	–
Bicarbonate (HCO_3^{-1})	Meq/l	0 – 10	7.18	2.30	3.56	1.50
Carbonate (CO_3^{-2})	Meq/l	0 – 0.1	0.84	0.24	–	–
Organic Content	%	–	0.15	–	–	–
EC	dS/m	0 – 3	20.3	15.8	13.9	14.2
pH	–	6.0 – 8.5	7.6	8.1	7.1	7.5

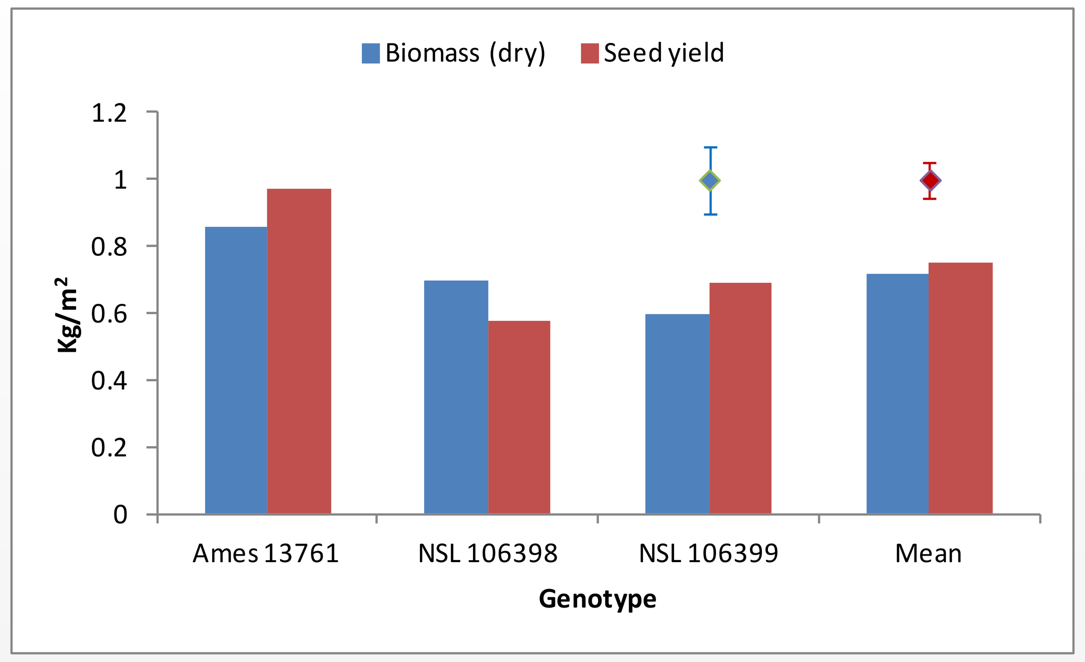

Figure 3. The mean biomass and seed yields of three quinoa accessions grown in salt-affected farms in the UAE. The error bars are Least Significant Differences (LSD) (P=0.05)

Conclusions

The results show that quinoa holds great promise for diversification of the agricultural production systems in degraded and salt-affected soils. However, introduction and scaling-up of quinoa in non-traditional environments requires further investigations on a wide range of soil types, besides a study of the entire chain, from planting to product – including the basics of production, product development, evaluation, marketing studies and economics.

Key references

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