

**Agronomical evaluation of *Chenopodium quinoa* Wild.
under rainfed piedmont environments in Tajikistan**



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Many natural (mineral weathering) and artificial processes (irrational irrigation and poor maintenance of drainage system induces soil salinization, thus, declining productivity of lands.

About 14-15% of the dry lands in Tajikistan are effected by salinity at different level.



In 2015, ICBA initiated a regional project titled “Cross-regional partnerships for improving Food and Nutritional Security in Marginal Environments of Central Asia” and introduced 5 quinoa lines for evaluation in various agro-ecologic zones in Central Asia, including 3 sub-regions of Tajikistan:

- 1.Lowland area, Kahtlon site
- 2.Plain areas, Rudaki site
- 3.Mountainous area (foothills), Fayzobod site

Main research objectives were:

When and how to cultivate quinoa and what genotypes under which agronomic conditions to produce the maximum output, i.e. grain and forage /stover production.



Results

Seed was planted on the 7th and 8th of April. Rudaki and Khatlon sites showed good germination within 5-10 days. In 2016 due to favorable unusual weather seed planted at the end of February (February 27 and 29, respectively).

| Cultivars | Origin | Rudaki 2015 | | | Rudaki 2016 | | |
|-----------|---------------|----------------|---------------|--------------------------|----------------|---------------|--------------------------|
| | | Date of sowing | Maturing date | Vegetation period (days) | Date of sowing | Maturing date | Vegetation period (days) |
| Q-1 | Ames 13727 | 7.04 | 5.08 | 120 | 27.02 | 22.06 | 116 |
| Q-2 | Ames 13742 | 7.04 | 21.07 | 105 | 27.02 | 8.06 | 102 |
| Q-3 | Ames 13761 | 7.04 | 15.07 | 98 | 27.02 | 29.05 | 92 |
| Q-4 | Ames 22157 | 7.04 | 10.08 | 125 | 27.02 | 25.06 | 119 |
| Q-5 | NSL 106398 | 7.04 | 11.07 | 94 | 27.02 | 27.05 | 90 |

Quinoa seed production in Khatlon site, 2015-2016

| Cultivars | Origin | Khatlon 2015 | | | Khatlon 2016 | | |
|-----------|---------------|----------------|---------------|--------------------------|----------------|---------------|--------------------------|
| | | Date of sowing | Maturing date | Vegetation period (days) | Date of sowing | Maturing date | Vegetation period (days) |
| Q1 | Ames 13727 | 10. 04 | 2.08 | 113 | 29.02 | 17.06 | 110 |
| Q2 | Ames 13742 | 10. 04 | 22.07 | 102 | 29.02 | 7.06 | 102 |
| Q3 | Ames 13761 | 10. 04 | 13.07 | 93 | 29.02 | 29.05 | 91 |
| Q4 | Ames 22157 | 10. 04 | 7.08 | 118 | 29.02 | 22.06 | 115 |
| Q5 | NSL 106398 | 10. 04 | 9.07 | 89 | 29.02 | 29.05 | 91 |

Vegetation period of different type of cultivars at our climate conditions were vary ranging from 89 to 125 days (pretty wide).

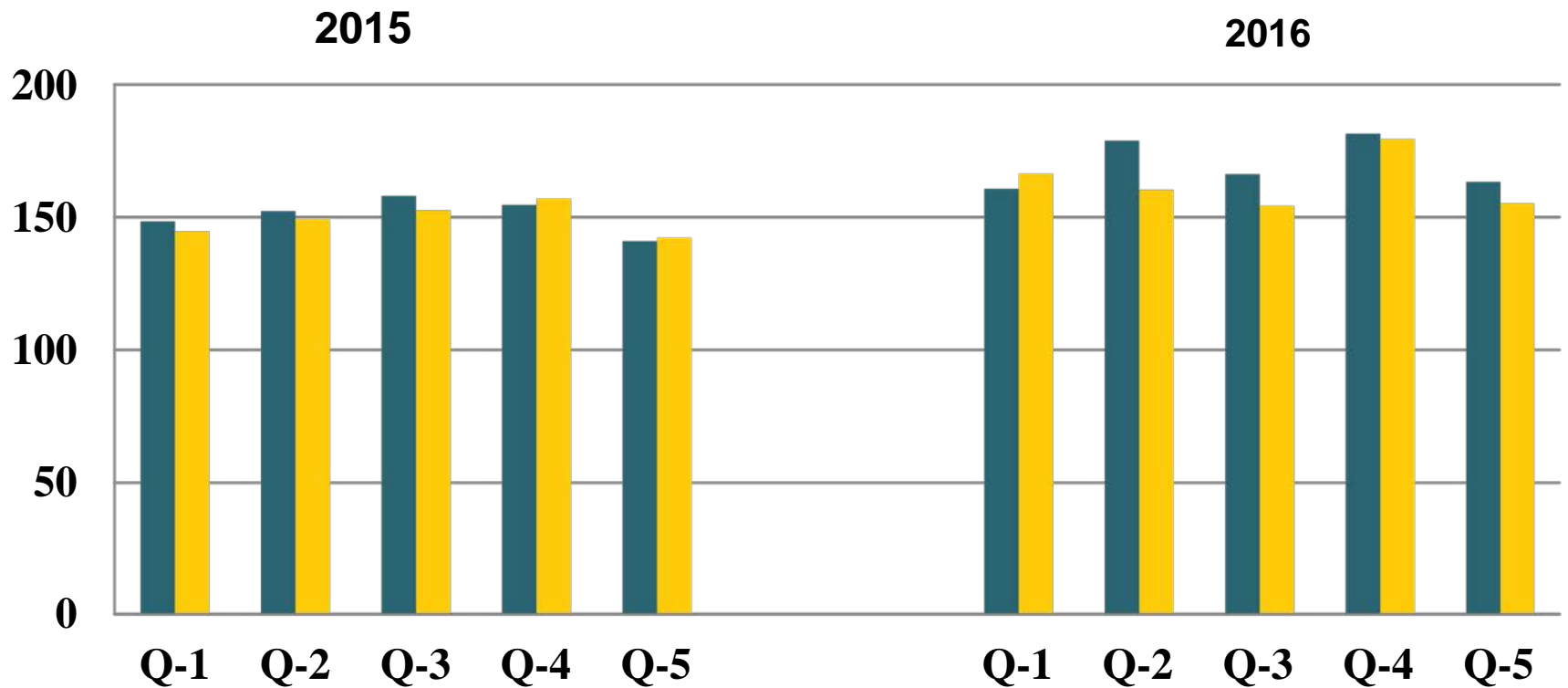
Thus, we classified as:

1. **Early- maturing (89 - 100 days)**
2. **Medium maturing (105 – 115 days)**
3. **Late maturing (120-125 days)**

The quinoa cultivars cultivated in Tajikistan was characterized as **medium** and **short height** plants ranged from **141** to **183** cm. At our knowledge the height of the plants were effected by climate conditions and date of planting.



Height of the quinoa cultivars (cm) at vegetation period at Rudaki and Khatlon sites, 2015 - 2016



| | Q-1 | Q-2 | Q-3 | Q-4 | Q-5 | | | Q-1 | Q-2 | Q-3 | Q-4 | Q-5 |
|----------------|-------|-------|-------|-------|-------|--|--|-------|-------|-------|-------|-------|
| ■ 2015 Rudaki | 148.4 | 152.3 | 158 | 154.6 | 141 | | | 160.7 | 178.8 | 166.2 | 181.4 | 163.3 |
| ■ 2015 Khatlon | 144.7 | 149.2 | 152.6 | 157.1 | 142.2 | | | 166.4 | 160.3 | 154.3 | 179.4 | 155.2 |



Maximum accumulation of dry and green biomass occurred at full flowering stage.



Average biomass of five cultivars at flowering stage at Rudaki and Khatlon sites, 2015-2016

| | Rudaki 2015 | | | Rudaki 2016 | | | Khatlon 2015 | | | Khatlon 2016 | | |
|-----------|--|-------------|------|---------------|-------------|------|---------------|-------------|------|---------------|-------------|------|
| Cultivars | Biomass accumulation at flowering stage (average from 5 plants, gr) | | | | | | | | | | | |
| | Green biomass | Dry biomass | % | Green biomass | Dry biomass | % | Green biomass | Dry biomass | % | Green biomass | Dry biomass | % |
| Quinoa 1 | 956,6 | 457,0 | 47,7 | 1167,2 | 493,0 | 42,2 | 1015,0 | 395,6 | 38,9 | 1115,8 | 400,0 | 35,8 |
| Quinoa 2 | 808,9 | 405,1 | 50,0 | 1213,5 | 536,7 | 44,2 | 904,2 | 383,7 | 42,4 | 1149,4 | 427,3 | 37,1 |
| Quinoa 3 | 736,2 | 372,3 | 50,5 | 1282,1 | 574,4 | 44,8 | 874,4 | 372,1 | 42,5 | 1237,0 | 567,2 | 45,8 |
| Quinoa 4 | 923,3 | 400,2 | 43,3 | 1021,5 | 489,2 | 47,9 | 944,8 | 388,2 | 41,1 | 997,0 | 401,3 | 40,2 |
| Quinoa 5 | 902,1 | 245,2 | 27,2 | 1013,7 | 492,3 | 48,5 | 936,5 | 394,7 | 42,1 | 969,4 | 392,2 | 40,4 |

Biometric analysis to identify green and dry biomass at laboratory condition

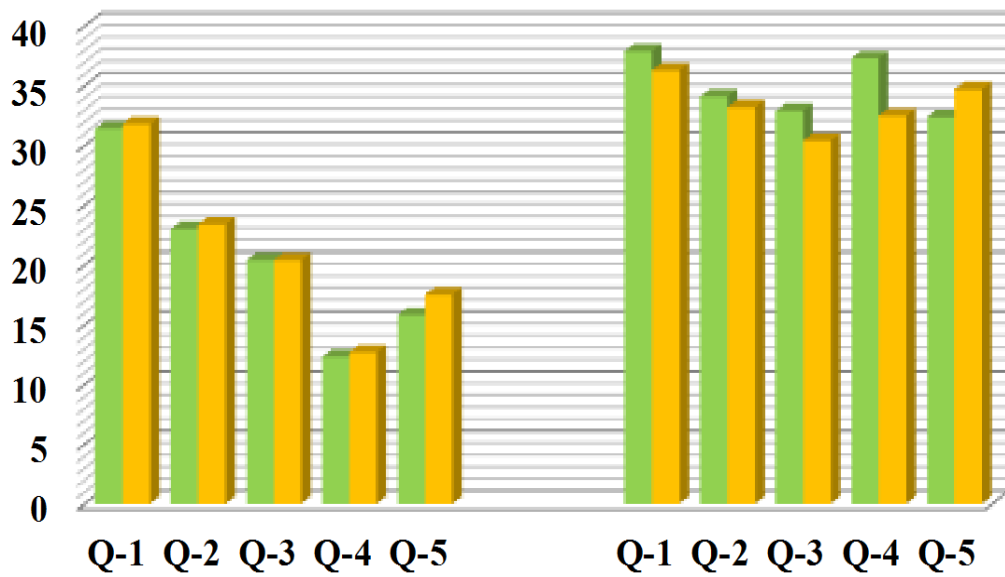


Biomass accumulation of five cultivars at flowering stage at Rudaki and Khatlon sites, 2015-2016

| № | Rudaki ton/ha | | | | Khatlon ton/ha | | | |
|----------------|---------------|-------------|---------------|-------------|----------------|-------------|---------------|-------------|
| | 2015 | | 2016 | | 2015 | | 2016 | |
| | Green biomass | Dry biomass | Green biomass | Dry biomass | Green biomass | Dry biomass | Green biomass | Dry biomass |
| Quinoa1 | 16,26 | 7,76 | 19,84 | 8,38 | 17,25 | 6,72 | 18,96 | 6,85 |
| Quinoa2 | 15,75 | 6,88 | 20,63 | 9,12 | 15,37 | 6,52 | 19,54 | 7,20 |
| Quinoa3 | 12,51 | 6,32 | 21,80 | 9,67 | 14,86 | 6,32 | 21,03 | 9,64 |
| Quinoa4 | 15,69 | 6,83 | 17,36 | 8,31 | 16,06 | 6,59 | 16,95 | 6,82 |
| Quinoa5 | 15,33 | 4,16 | 17,23 | 8,36 | 15,92 | 6,70 | 16,48 | 6,86 |

Seed yield at Rudaki and Khatlon sites, 2015-2016

| № | Rudaki kg/ha | | Khatlon kg/ha | |
|-----|--------------|------|---------------|------|
| | 2015 | 2016 | 2015 | 2016 |
| Q-1 | 31,4 | 37,9 | 31,8 | 36,3 |
| Q-2 | 23,0 | 34,1 | 23,4 | 33,2 |
| Q-3 | 20,4 | 32,9 | 20,4 | 30,4 |
| Q-4 | 12,3 | 37,3 | 12,7 | 32,5 |
| Q-5 | 15,8 | 32,4 | 17,5 | 34,7 |



■ Rudaki 2015
■ Khatlon 2015

■ Rudaki 2016
■ Khatlon 2016



The research findings underlined that date of sowing strongly effected on the maturing process, green yield and biomass of the plant



Investigation results from 2015-2016 on optimal date of sowing indicated that the end of February is the most appropriate time for planting in Tajikistan, a month earlier that actual sowing date.



Comparative studies at both sides indicated the quinoa sensitivity to summer strong temperature fluctuation:

temperature higher than 44 °C is affecting the seed production of quinoa in the plain areas



Based on agrobiological assessment of Quinoa cultivars from ICBA the followings are concluded:

- ✓ to establish participatory approach for seed production of best adapted to Tajikistan marginal environment ;
- ✓ involve in seed multiplication interested farmers and private sectors;
- ✓ we are interested to obtain a large spectrum of quinoa improved lines from ICBA or other countries for promotion and adoption to the country level;
- ✓ establish an in-situ an dex-siytu seed bank ; documentation and conservation of quinoa best lines at Tajikistan level; we will be glad to become a part of International Quinoa Network
- ✓ to develop a monitoring and breeding program for quinoa
- ✓ based on 2 years results we selected Q5 as the best early-maturing lines for mass selection and introduction in Tajikistan



Thank you for your attention!