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## Prospect of Quinoa Cultivation for Sustainable Hill Agriculture of Northeast, India

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Keeping in view the nutritional value of quinoa and for higher income returns of small and marginal farmers in northeast hill region of India, 13 selected accessions of quinoa were evaluated in mid hill condition. Based on yield per plant EC-507747 (16g) followed by IC-411824 (12.94g), EC-507739 (9.75g) and EC-507738 (9.61) were identified as promising in local climatic conditions.

### Introduction

Quinoa (*Chenopodium quinoa*) is incredibly nutritious crop and can be grown in wide range of agro-ecological conditions with variant altitudes. It is tolerance to drought, sturdy, short duration, and resistance to pests and diseases. It is also rich in fibre, minerals, antioxidants, contained all the nine essential amino acids with naturally gluten-free make it as one of the healthiest and most nutritious foods on the planet. Thus, NASA have selected it as suitable for growing in space under (CELSS). With its immense potential and importance to food and nutritional security, UN declared the year 2013 as “The International Year of Quinoa”. With the ever increasing of populations, there is a need to look beyond the horizon for climate resilient crops for future food and nutritional security. Keeping in view with all these facts of quinoa, performance evaluation for identification of promising accessions of quinoa was carried out in mid hill of eastern Himalayan.

### Materials and methods

As set of 13 accessions of Quinoa was evaluated in mid hill condition at ICAR Basar, Arunachal Pradesh situated at 93.57°E longitude to 95.23°E longitude to 27.69°N to 29.20°N latitude with an altitude of 650 m above mean sea level. Sowing was done in the first week of November following standard agronomic practices with spacing row to row spacing of 30 cm and plant to plant spacing of 15 cm. Various yield contributing parameters like days to fifty percent flowering (DFF), days to maturity (DM), plant height (PH) cm, inflorescence length (IFL) cm, yield per plant (YPP) and test weight (TW) of 10 ml seed (g) were recorded.

### Results and Discussion

The performance of the accessions varied significantly for various growth and yield traits. The field performance is illustrated in Fig. 1. Mean days to fifty percent flowering varied from 59.34 to 72 with a mean of 68.24 days. Days to maturity ranged from 98.34 to 114.34 with a mean of 103.98 days. Plant height varied from 67.31 to 99.87 cm with an average of 79.65 cm. The main inflorescence length varied from 14.99 to 33.03 with a mean of 24.15 cm. Test grain weight ranged from 5.14 to 5.96 g with a mean of 5.57g (Fig. 2). While the highest yield per plant was recorded in EC-507747 (16g) followed by IC-411824 (12.94g), EC-507739 (9.75g) and EC-507738 (9.61) respectively (Fig. 3). This indicates that quinoa can be successfully cultivated for sustainable food and nutritional security in hill agriculture.

Since the farming system in the northeastern hill region is predominantly rice and most of the field lie's fallow in rabi. The promising accessions identified in our study could be can be promoted and scaled up the cultivation of quinoa in the region. Quinoa is climate resilient crops that can tolerates erratic rainfall, temperature fluctuations, frost, and poor soil conditions, it can be a complementary crop in terrains and shifting weather patterns of the hills. Due to its superior nutrition content especially gluten-free with the only crop with complete profile of all nine essential amino acids, it is also regarded as "superfood". Hence it can be an excellent weapon against malnutrition in rural hill communities consuming only rice as staple food. Further, due to its high economic value this crop can bring higher net returns to smallholder and marginal farmers in the region. To augment the production, awareness and popularization of this prized crop need to be taken through frontline demonstration and necessary market linkages through FPOs. During the cultivation of quinoa care has to be taken about the seed storage with optimum moisture level. Because it was observed that the seed germination percentage is drastically affected by improper storage.



Fig. 1: Field performance of quinoa during early reproductive stage

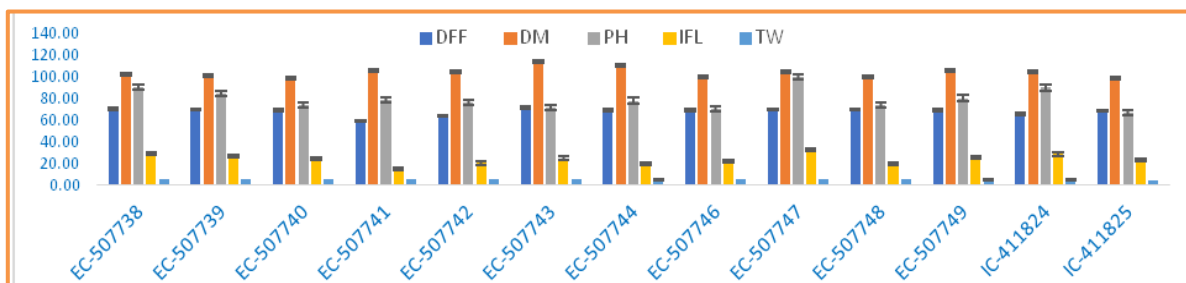


Fig.2: Mean variations of days to fifty percent flowering (DFF), days to maturity (DM), plant height (PH), inflorescence length (IFL) and test weight (TW) of quinoa accessions in mid hill conditions.

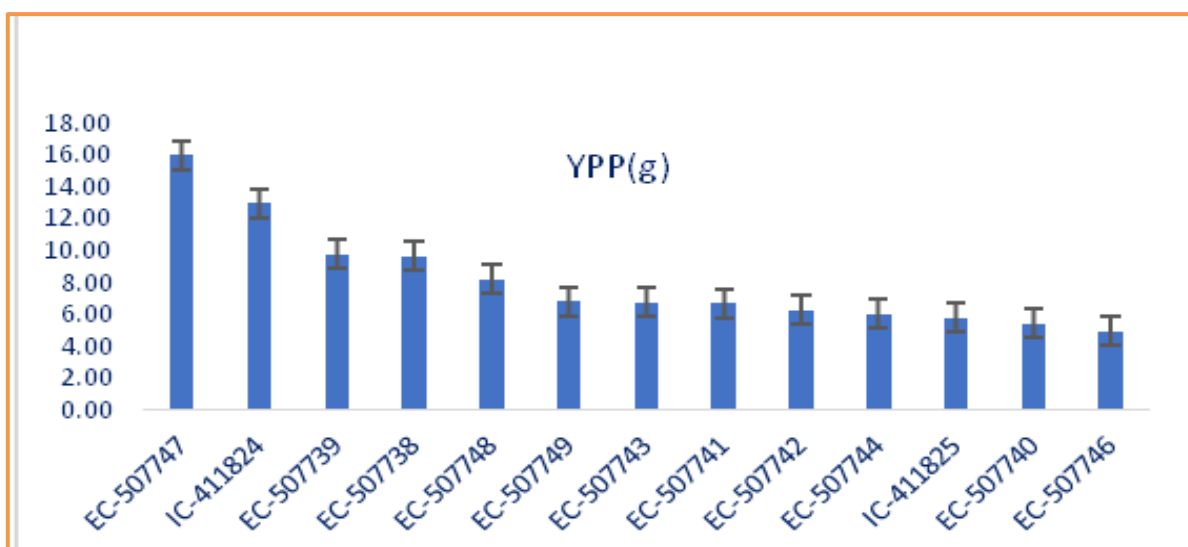


Fig. 3: Performance of yield per plant (YPP) of 13 quinoa accessions under mid hill conditions

### **Conclusion**

Quinoa requires relatively low inputs which thereby lowers the overall farming costs and could be a potential supports organic/ natural farming for sustainable farming practices. In spite of its unmatched nutritional value and demand in international market, the farmers in the region are not aware about these crops and still remains as underutilized crop. Thus, awareness and frontline demonstration could pave the way for popularizing of this prized crop.