

Short Communication

Effects of Rainfall on Physiological Seed Quality of Grain Amaranthus (*Amaranthus Hypochondriacus* L.) Cv. Suvarna

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ABSTRACT

The study was conducted at Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore during the period from July to October, 2007 to find out the effects of rainfall on physiological seed quality of grain amaranthus (*Amaranthus hypochondriacus* L.) cv. Suvarna. The results revealed that, grain amaranthus crop should be sown from early sowing in Kharif season harvesting higher seed yield with physiological seed quality. Between the crops, Kharif season was better than late sowing as the seeds would be exposed to rain and the rain discolored the seed and reduced its physiological seed quality of grain amaranthus.

Key words: Grain amaranthus, rainfall, sowing time, seed yield, physiological seed quality.

INTRODUCTION

Grain amaranthus (*Amaranthus hypochondriacus* L.) is the cheap, greatly nutritive and most popular leafy vegetable is being propagated by seeds. Leafy vegetables in addition to their very important role in health and nutritional security of human beings and its play a major role in improving the economy of people of the country. [1] India is mainly a vegetarian country, but could not attain self-sufficiency in vegetable production. One of the main reasons attributed is non-availability of adequate quantity of quality seeds to produce adequate vegetables. Therefore, there is an urgent need for augmenting the production of vegetables and vegetable seeds to meet

out the minimum needs as well as ensuring the nutritional security of the fast growing population. The use of good quality seed is indispensable for the successful production of any crop. At present, the knowledge regarding the effect of environmental factors on seed production is meagre. An understanding of the plant morphology and its relationship with seed yield as influenced by season and planting method for seed is an essential step towards identifying best season. Increased vigour and high productivity were observed when the crop was grown in early sown kharif than late sown kharif season. However, the incidence of insect-pests and diseases is very high during rainy season, which significantly

affects the quantity and quality of seeds. The results showed that at the seed become dull coloured (orange white group 159B) with the late sown kharif crop due to the coincidence of maturation period with rainfall which lead to reduction in physical and physiological seed quality characters than early sown kharif crop. Therefore, the present investigation was, undertaken this research to study the effects of rainfall on physiological seed quality of grain amaranthus cv. Suvarna.

MATERIALS AND METHODS

This study was conducted at Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore (Latitude 11°02'N; Longitude 76°57'E; 426 MSL) from July to October, 2007. The crop raised during kharif 2007 with the date of sowing as 24.08.07 (last week of August) had caught in rains during maturation period to evaluate the influence of rain (Figure -1) on yield and resultant seed quality characters. Adopting the fertilizers dose of NPK@ 40:20:20 kg ha⁻¹ and the spacing of 45 x 15 cm in plots of size 4 x 4 m² with 13 replications and Harvesting was done when all the seeds maturity. The data observed were compared with the crop raised during the last week of July (24.07.07) for the following seed yield and quality determinations. The data collected and observed for the following parameters. The resultant seeds were evaluated for their seed quality characters such as colour of the seed was visualized at each stages based on the Royal Horticultural Society Garden colour chart and was recorded, germination (%) (ISTA, 1999),^[2] seedling length (cm) the distance between the tip of the primary leaf to the tip of the primary root, vigour index^[3] (Abdul Baki and Anderson, 1873). Vigour index (VI) was computed using the following formula and expressed as whole number. VI =

Germination percentage × Seedling length (cm) and Dry matter production (g·seedlings⁻¹) dried in a hot air oven maintained at 85°C for 48 h and cooled in a dessicator for 30 min and weighed in an electronic digital balance. The data pertaining to the experiment were subjected to statistical analysis by analysis of variance method as suggested by Gomez and Gomez.^[4]

RESULTS AND DISCUSSION

The results of the experiment indicate that the effect of rainfall on seed quality characters have significant effect on seed yield and its quality parameters. The results showed that the rainfall during the July to October, 2007 was found to be deleterious for grain amaranthus seeds yield. Grain amaranthus crops received 10.2 - 156.1 mm of average monthly rainfall at seed formation to ripening stage, 22.00 - 33.00°C of average monthly temperature (Fig. 1). Among the environmental factors, rain is one of most important extrinsic factor that influences the quality characters of seed. In horticultural crop discoloration and pregermination of seed due to maturation rain as the cause for reduction in seed quality. In the present study, during maturation there was an interception of rain particularly with late sown crop (24.08.07) compared to the early sown crop (24.07.07). Hence attempts were made for analyzing seed yield and seed quality characters of late sown kharif crop compared with early sown kharif crop. Reddy^[5] reported that in horse gram the rain damage causes cracks on seed coat due to hydration and dehydration of seeds that occur due to the natural process of wetting and drying owing to the natural exposure of seed to rainy and sunny day climates. This wetting and drying have affected the seed coat integrity that lead to invasion of storage pathogen which in turn affects the quality of seed by causing seed discolorations.

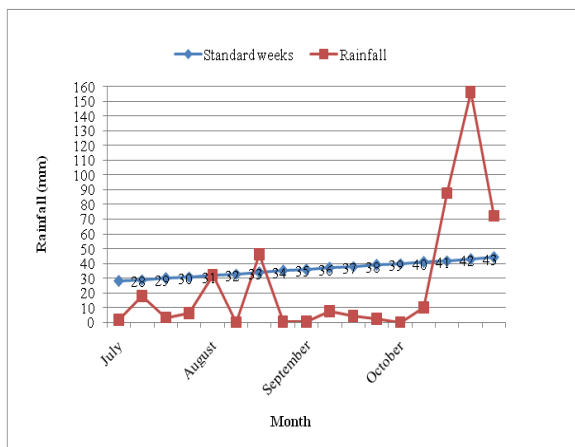
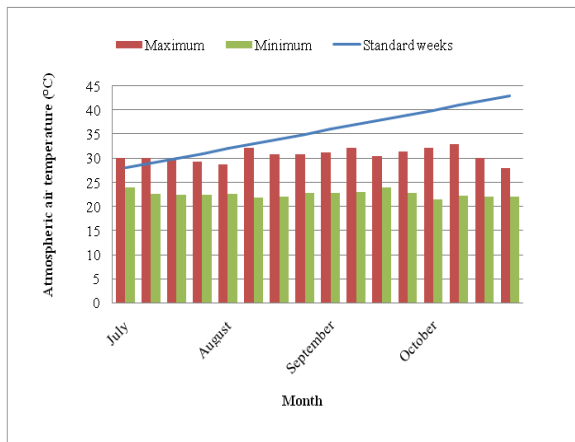


Figure 1. Weather parameters at Coimbatore, Tamil Nadu during 2007:(a) air temperature and (b) rainfall

In the present study, the seeds of late sown crop was completely discoloured due to the interpretation of the rain at the time of maturation stage (Figure 2) which resulted in poor quality of fresh seeds compared to the early sown kharif crop, due to the rain soaking which occurred as natural event. The rain soaked seeds were also dull in colour might be due to the microbial attack and the heat developed due to higher respiratory event that occur normally with wet or high moist seed as a natural process. Seed discolouration not only reduced the market value but also alters the quality and storability of seed converting them unsuitable to use as seed. Neergaard [6] expressed that even if the seed was viable

with recommended germination as per certification standards, many a time it may not be acceptable as seed for sowing because of poor physical appearance and highly expected incidence of seed borne fungi. In agricultural crops like sorghum and pulses also researchers have mentioned about this rain soak injury and expressed that the seeds should not be selected for seed purpose in these situations expressed that seed coat colour as the unique genetic factor that varies with crop in most cases and sometimes with varieties. [7] But this genetic colour could be altered to some extent for their varying shades due to the changes in the environmental conditions or seed developmental stages or fungal attack. The colour of grain amaranth seed that soaked in rain was orange white group 159D while the normal orange white group 159B of seed as per Royal Horticultural Society Gardens guidelines.



Figure 2. Influence of rain soaking on seed colour of grain amaranthus

In the present investigation, in line with seed discolouration, the performance of early sown good seeds was 24 per cent higher than rain affected seeds in terms of seed germination. This is coherent with results in peas seed quality variations due to seed coat colour which might have occurred either due to the seasonal variations or due to rain or high relative humidity. [8] The physical and physiological seed parameters evaluated viz., Seed yield plant⁻¹(38.0 g) early sown kharif and (30 g) in late sown kharif, 100 seed weight, germination, root length and shoot length respectively registered 5.0, 31.0, 18.0, 14.0 per cent increased values for orange white group

159B i.e. with normal coloured seed compared to orange white group 159D coloured seed that was soaked in rain due to late sowing. Moreover, effects of rainfall on seedling dry weight seedling in normal crop 7.63 mg and 6.42 mg in rain soaked, and dry matter production (10 seedling⁻¹) were higher in early sown kharif by 19.0 % over late sown kharif (Table 1). This study was confirmed by Nautiyal [9] found that, analysis of total sugars in seeds of different maturity stages showed that higher sugars in IMM seeds may be responsible for imbibitional injury due to absorption of excessive water resulting in poor germination.

Table 1. Influence of rain on seed yield and quality of grain amaranthus

Yield and quality parameters	Early sown Kharif (Normal)	Late sown Kharif (Rain soaked)	SEd	CD(P=0.05)
Seed colour	Orange white group 159D	Orange white group 159B		
Seed yield plant ⁻¹ (g)	38	30	0.651	1.334
100 seed weight (mg)	88	84	0.032	0.069
Germination (%)	92	70	1.253	2.576
Root length (cm)	5.3	4.5	0.101	0.208
Shoot length (cm)	4.0	3.5	0.043	0.089
Drymatter production 10 seedling ⁻¹ (mg)	7.63	6.42	0.081	0.167
Vigour index	855	560	8.470	17.41

The Vigour Index values were higher in early sown crop by 35 % compared to the late sown crop of grain amaranthus (Table 1). This might be due to prevailing high or low temperature at seed formation and development stage also affects the quality of seed, which deteriorates at faster rate. However, the present investigation highlighted that when the crop was exposed to rain at the time of maturation prior to harvest, the colour of seed become dull and these discoloured seed reduces the quality characters of the seed developed normally all through the production cycle. Thus, the study expressed that late sowing of crop were not been favourable because of the requisite of dry weather condition. Probably, plant growth, pod setting, and seed germination were adversely affected by the wet weather in late sown crop. The dry

weather at the time of ripening of spike with early sowing hastened the quantity of quality seeds. Similar results were also reported by Randhirsingh et al [10] in cowpea. The present study also indicated that the crop not exposed to environmental condition produced seeds with orange white group 159B which registered better seed quality characters due to their better stamina in physical, physiological and biochemical phenomenon while the crop exposed to rain during harvest due to late sowing produced seed with higher proportion of dull coloured seed which has had a remarkable reduction in seed and seedling quality characters.

CONCLUSION

From the present study, it is concluded that grain amaranthus crop should be sown from early sowing in Kharif season

harvesting higher yield with quality seed. Between the crops, Kharif season was better than late sowing as the seeds would be exposed to rain and the rain discolored the seed and reduced its physiological seed quality of grain amaranthus.

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