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Short Communication

COLOUR OF SPIKE AS AN INDEX OF HARVESTABLE MATURITY OF GRAIN AMARANTHUS

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Grain amaranthus (*Amaranthus hypochondriacus* L.) is the cheap, highly nutritive and most popular leafy vegetable being propagated through seeds. Favourable composition of grain amaranthus flour helps to prevent certain diseases (heart conditions, diabetes and brain stroke), and its high content of fiber and starch has a positive effect on digestion disorders (Peterka *et al.*, 2001). Stage of maturity at harvest is one of the most important factors that can influence the quality of seeds (Demir *et al.*, 2008). Harvesting too early may result in low yield and quality, because of the partial development of essential structures of seeds (Wang *et al.*, 2008). Whereas, harvesting too late may increase the risk of shattering and decrease the quality of seeds due to ageing. Adverse environmental conditions such as rainfall or precipitation may also result in sprouting of seeds on mother plants. Therefore, successful seed production depends on detection and prompt harvesting at this appropriate time. Colour of seeding body is an index of seed maturation in many of the agricultural, horticultural and sylvicultural crops. Standardization of inflorescence colour for any of crop species for collection of good quality seeds would be highly useful for seed collectors even if they lack in technical skill. Fixation of optimum stage of physiological as well as harvestable maturity will ensure better quality seeds and reduces the loss caused by pre-harvest factors. Reliable information on optimum stage of harvest will enable the seed producer to harvest the seed crop in time. Hence, knowledge on development of spike colour as an index of harvestable maturity will be valuable in quality seed production. Hence the present study was carried out in grain amaranthus Cv. Suvarna to elicit information on the harvestable maturity.

The experiments were carried out at Department of Seed Science and Technology of the Tamil Nadu Agricultural University, Coimbatore. Seeds were sown in raised nursery bed and transplanted to the main field at 12 days after sowing in 4 x 4 m^2 plot size with 3 replications. The spacing and fertilizer schedule adopted were 45 x 15 cm and 40 Kg N + 20 Kg P_2O_5 + 20 Kg K_2O ha^{-1}. The amaranthus spikes harvested in bulk were classified into four categories based on colour of the spike as green group 142C, green group 142D, yellow group 10D and yellow group 11D using the Royal Horticultural Society Garden colour chart. In the categorized spikes, fresh weight $spike^{-1}$, dry weight $spike^{-1}$, seed recovery, graded seed recovery, spike colour, spike length, spike breadth were recorded. Seedling quality characters *viz.*, 100 seed weight, seed germination, seedling length and dry matter production were observed as per ISTA (1999) and vigour index values (Abdul baki and Anderson, 1973). Seeds were also evaluated for protein content (Alikhan and Youngs, 1973).

Table 1: Influence of colour of spike as an index of harvestable maturity on spikes and seed characters

Spike Characters	Green group 142C	Green group 142 D	Yellow group 10 D	Yellow group 11D	SEd	CD (P=0.05)
Spike length (cm)	50	55	63	57	1.21	2.65
Spike breadth (cm)	20	20	23	22	1.25	2.72
Fresh weight $Spike^{-1}$ (g)	213	186	165	140	1.48	3.24
Dry weight $Spike^{-1}$(g)	65.0	71.0	74.6	73.0	1.13	2.46
Seed recovery (%)	36	40	55	48	1.67	3.64
Graded seed recovery (%)	92	94	95	95	1.33	2.90
Seed Characters						
100 seed weight (mg)	78	80	90	85	1.16	2.39
Germination (%)	92	95	97	95	2.33	4.95
Root length (cm)	5.0	5.0	5.7	5.4	0.16	0.37
Shoot length (cm)	3.6	3.8	4.0	4.0	0.10	0.22
Dry matter production10 $seedling^{-1}$ (mg)	6.5	7.8	8.5	8.3	0.04	0.09
Vigour index	791	836	941	893	1.18	2.57
Protein content (%)	15.60	15.56	15.38	15.40	0.19	NS

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The evaluation of spike colour categories for spike characters revealed that the yellow group 10D coloured spike recorded 21, 13, 13 and 33 % higher values for spike length (63.0 cm), breadth (23.0 cm), dry weight (73.0 g) and seed recovery (55 %) than green group 142C respectively except fresh weight of spike. Similarly (yellow group 11D) recorded 12, 9.0, 8.0 and 21 % higher values for spike length, breadth, dry weight and seed recovery than Green group 142C and yellow group 4D coloured spike (Table 1). Similar variation with the fruiting body on harvest was reported by Srimathi (1997) in fruit crops and Vadivelu *et al.* (1991) in tomato which had been attributed to the sequential development of the inflorescence or the seeding body to attain maturation and also the depletion of chlorophyll content on ripening. The analysis on seed quality characters among the colour categories revealed that the seed germination recorded by the seeds of green group 142C spikes were 92 %, and it increased to 95 % with the green group 142D and yellow group 11D spikes. Maximum seed quality as measured by seed viability, moisture content, seed mass and germination percentage was obtained at the point of mass maturity. These results agreed with the findings of Tekrony and Egli, 1997. But maximum germination of 97 % was recorded with the yellow group 10D coloured spikes. The vigour of seeds evaluated through root length, shoot length, dry matter production and vigour index were also the highest with seeds of yellow group 10D coloured spike (Table 1). Low seed quality at the early stages of seed physiological maturity was due to immaturity while the decline in quality parameters by seed ageing (Ghassemi-Golezani and Mazloomi-Oskooyi, 2008). The performance of seeds from yellow group 10D coloured spike were 7.0 % higher than green spikes in terms of seed germination, while the vigour index of seeds were 16 % higher than green group 142C spikes. The protein content of grain amaranthus seeds with green group 142C, green group 142D, yellow group 10D and yellow group 11D spikes are on par with each other. These results agreed with the findings of Vadivelu *et al.* (1991) in tomato. Hence harvesting of the inflorescence with these spike characteristics would be highly useful in this grain crop, where the maturation of spike would not be uniform and the delay in harvesting leads to shattering loss up to 6.0 % depending on the delay and the discolouration of seed due to fungal invasion and the exposure of seed field weathering, that were known for poor quality (Naik *et al.* 1996).

It may be concluded that the seeds from yellow group 10D coloured spikes registered the maximum germination (97.0 %) and seedling vigour including spike characters, while the seeds of green group 142C spike were inferior in seed and seedling quality characters.

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