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RESEARCH PAPER

Seed development and maturation studies in barnyard millet cv. MDU 1

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Abstract : The present investigation was carried out during 2016-2017 to identify the seed development maturation studies in Barnyard millet cv. MDU 1. The results revealed that seeds attained physiological maturity on 50 days after anthesis as evidenced by the maximum panicle length (30.7 cm), fresh weight (31.2 g), dry weight (23.5g), fresh weight of the seeds (23.4g) and dry weight of the seeds (14.5g). The change of colour of panicle and seed from green to dark brown could be considered as a visible index of maturity. The seed quality parameters *viz.*, germination (51 %), shoot length (9.59 cm), root length (18.5 cm) and dry matter (0.025 g/10 seedlings) and vigour index (1175) were also maximum at 50 days after anthesis.

Key Words : Barnyard millet, Seed development, Physiological maturity, Anthesis

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INTRODUCTION

The increasing lifestyle diseases among the population due to eating of the unavoidable foods like rice and wheat, nature also given an alternate nutri-cereals for mankind's are small seeded grains called small millets. Of them, barnyard millet (*Echinochloa frumentacea*), a highly self-pollinated crop which belongs *Poaceae* family has ability to persist under severe drought, salinity, heat, floods and have excellent climate resilient capacity compared to other cereal crops. Grains are cultivated mainly for food and the straw has a good fodder value (Gopalan *et al.*, 2008). The carbohydrate, protein content and good amount of dietary fibre makes slow digestion of food by the way the amount of glucose moving in the blood per second also slow, hence it said to be low glycemic food that is favorable for the diabetic person and who is engaged in sedentary activities.

The crop is largely grown in harsh and fragile environments, with minimal use of agricultural inputs due to its remarkable ability to withstand erratic rainfall and varying weather conditions (Kumar *et al*., 2007).

The crop is valued for its drought tolerance (Dwivedi *et al*., 2012), short growth period (sometimes in as little as six weeks) (Wanous, 1990) and superior nutrition value (Saleh *et al*., 2013). These characteristics make it an important supplemental crop for small-scale farmers because they can plant and harvest it between major

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crop growing seasons.

The demand for high quality seeds has increased greatly in the recent years. In order to obtain high quality seeds, the seeds are to be harvested rightly at maturity. The level of viability and vigour are determined by the extent of seed development when the crop is harvested.

Seed maturity is the crucial and most important factor determining the seed quality under successful seed production programme (Austin, 1972). It is understood that seed maturation is the gradual preparation for germination (Bewley and Black, 1994). The development process during seed growth and maturity interacts with the production environment to determine the planting quality of a seed. It is well established that seed quality is the highest at physiological maturity which precedes harvestable maturity. This practice would permit quick harvesting at appropriate timings, resulting in better field management (Delouche, 1973). Hence, knowledge on development of seed from fertilization to maturity is highly warranted in barnyard millet.

MATERIAL AND METHODS

The study was conducted with barnyard millet seeds var. MDU 1obtained from Plant Breeding and Genetics, Agricultural College and Research Institute, Madurai. The field experiment was conducted at Department of Seed Science and Technology, Agricultural College and Research Institute, Madurai to trace the pattern of seed development and maturation, where all the agronomic practices were carried out as per recommendation.

Experimental details :

Design	Randomized Block Design (RBD)
Replication	3
Season	*Kharif* (2017) during June – October
Spacing	25 x 10 cm
Plot size	5 m x 4 m

Treatment details :

T_1- 5 DAA
T_2- 10 DAA
T_3- 15 DAA
T_4- 20 DAA
T_5- 25 DAA
T_6- 30 DAA
T_7- 35 DAA
T_8- 40 DAA
T_9-45DAA
T_{10}-50DAA
T_{11}-55DAA
(DAA – Days after anthesis)

During anthesis, randomly selected panicles were tagged to study the physiological maturity. Panicles were harvested at five days intervals upto 55 days after flowering. The observations on panicle length, width, fresh weight, dry weight and physiological quality of seeds *viz.*, germination (ISTA, 1999), root length, shoot length, dry matter production and vigour index (Abdul-Baki and Anderson,1973) were recorded. Data obtained were analysed using "F" test for significance following the methods described by Panse and Sukhatme (1999).

RESULTS AND DISCUSSION

Seed maturity refers to the physiological and functional changes that occurs from time of anthesis until the seeds are ready for harvest. Studies on pattern of seed development and assessment on time and indices of maturity have greater practical utility on production of quality seeds. In the present study, the pattern of seed development and maturation in barnyard millet was traced out to fix the optimum time and indices of physiological maturity for harvesting quality seeds. In the present investigation the observations taken on the panicle characters revealed that panicle length observed a study with advance in maturity from 5 DAA (28.7cm) to 50 DAA (30.7cm). The fresh weight of panicle attained maximum at 50 DAA (31.2g) there after decreased. The dry weight increased from 3.2g at 5 DAA and attained maximum of 23.5g at 50 DAA. The rapid growth at initial stages might be due to more uptake of water when the intake of carbon and nitrogen was comparatively low (Patel *et al*., 1977). The declining trend might be due to the rapid dehydration and strinking of matured panicles (Sundereswaran *et al*., 2011; Jayanthi *et al*., 2013 and Ragupathi, 2017) (Fig 1).

Loss of moisture during ripening and maturation of panicle and seed is a common phenomenon and has been observed in many crops (Natarajan and Srimathi, 2008, Sundereswaran *et al*., 2011 and Ragupathi, 2017). In the present study there is significant difference in moisture content of panicle and seed at different stages of seed development and maturation. The moisture content of panicle was maximum at 5 DAA (78.5%).This might be due to quick development of seeds and high moisture content at earlier stages of development and subsequent dessication at later stages and also due to

Fig. 1 : Changes in fresh weight (g) and dry weight (g) of the panicle and seed during Seed development and maturation in barnyard millet cv. MDU 1

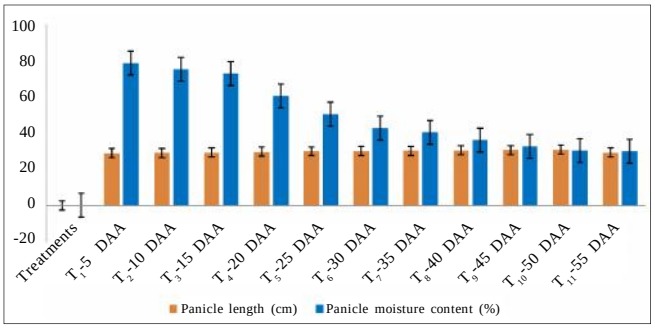

Fig. 2 : Changes in panicle length (cm) and moisture content (%) during Seed development and maturation in barnyard millet cv. MDU 1

replacement of osmotic material by starch and other large molecule with low hydration capacity (Milthorpe and Moorthy, 1979) (Fig 2).

Physiological maturation occurs commonly in seeds to recapture the reproducing capacity of the younger generation and this normally coincide with attainment of maximum dry weight, where the flow of nutrients are freezed to the seed from the mother plant, The developing seeds attained the potential for germination at 25 DAA (6%). There was a gradual increase in germination as the seed matures and reached maximum on 50 DAA (51%). The maximum germination at 50 DAA might be due to attainment of potentially for reproduction as spelt through mature embryo with essential structure and activation of the enzymes and nutrients required for regeneration of miniature plant.

The attainment of higher germination was coincided with the attainment of maximum dry weight of seed. This is in conformity with Vijaya *et al*. (1988); Raja and Palaniswamy (1988); Jayanthi *et al*. (2013) and Ragupathi (2017). The root and shoot length of the seedlings were also increased significantly upto 50 DAA (Table 1). This might be due to maximum drymatter accumulation of the seeds provided more energy in the growth process.

The seedling length and drymatter which was in coincidence with stages of dry weight of seed and germination. The similar results were obtained by

Table 1 : Changes in germination per cent, root length (cm), shoot length (cm), dry matter production (g) and vigour index during development and maturation in barnyard millet cv. MDU 1

Treatments	Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production g/10 seedlings	Vigour index	Seed moisture content (%)	Colour of seed visual observation
T_1 - 5 DAA	0.0	0.0	0.0	0.0	0.0	79.6(62.727)	White to light
T_2 - 10 DAA	0.0	0.0	0.0	0.0	0.0	60.5(50.769)	Green
T_3 - 15 DAA	0.0	0.0	0.0	0.0	0.0	56.2(48.447)	To
T_4 - 20 DAA	0.0	0.0	0.0	0.0	0.0	48.3(43.855)	Light yellow
T_5 - 25 DAA	6(14.179)	4.1	4.43	0.009	55	33.0 (35.062)	to
T_6 - 30 DAA	16(23.578)	7.3	8.12	0.015	201	27.7(31.307)	light brown
T_7 - 35 DAA	33(35.062)	14.1	8.92	0.018	636	26.3 (30.658)	to
T_8 - 40 DAA	41(39.816)	15.2	9.05	0.020	986	26.0 (30.658)	dark brown
T_9 - 45 DAA	49(44.428)	17.3	9.32	0.023	1031	25.6 (30.000)	
T_{10} - 50 DAA	51(45.574)	18.5	9.59	0.025	1175	25.0(30.000)	
T_{11} - 55 DAA	42(40.397)	17.4	7.33	0.020	1073	24.9(29.334)	
Mean	21.63	8.53	5.16	0.008	468.81	39.37273	
S.E.±	0.5094	0.1870	0.1551	0.0002	13.8517	0.9058	
C.D. (P= 0.05)	1.0627**	0.3901**	0.3235**	0.0004**	28.8942**	1.8894**	

(Figures in parentheses indicate arc sine values) (DAA – Days after anthesis)
** indicates significance of value at P=0.01

Plate 1 : Development and maturation of seedin barnyard millet cv. MDU 1

Jayanthi *et al*. (2013) and Ragupathi (2017). Dry matter production of seedlings was attributed as manifestation of the physiological efficiency dependant of seed vigour (Heydecker, 1972). The increase in dry matter production by the seedling and vigour index values were also exhibited the similar trend as that of germination, root length, shoot length, which indicated the attainment of physiological maturity of seeds at 50 DAA.

The moisture content decreases rapidly upto 55 DAA (24.9%) in seed. The reduction in moisture content due to advancement of maturity of seed might be due to desiccation and dehydration (Abdul Baki and Anderson, 1973). The decrease in moisture content accompanied with increased in dry weight of seeds upto 50 DAA indicated the continuous accumulation of food reserves in the developing seeds (Metha *et al*., 1993).

The colour changes could be observed where the panicle colour changed from light green to green to yellow and the colour change in seed where the white to light green to light yellow to light brown to dark brown coincide the physiological maturity stage of seed and it coincide at 50 DAA, the observed duration for seed development and maturation. Similar results in change of colour were also reported by Natarajan and Srimathi (2008); Sundereswaran *et al*. (2011) and Ragupathi (2017).

Conclusion:

Studies on tracing the pattern of seed development and maturation through physical and physiological character indicated that the seeds attained physiological maturation on 50 DAA with maximum germination (51%) Dry weight (0.025%) and vigour index (25.0).

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