IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Studies of quality seed production and vegetative multiplication in Guinea Grass cv. CO1 (Punicum maximum Jacq.)

Aman Kumar, Mousmi Syed, Mahipat Singh, Manish Verma

Institute of Agricultural Sciences, Bundelkhand University, Jhansi (U.P.)

Abstract

A experiment was conducted at Organic Research Farm, Karguanji, Department of Seed Science and Technology, Institute of Agricultural Sciences, Bundelkhand University, Jhansi (U.P.) during kharif season, 2023-24. The experimental material was grown in a Randomized Block Design with three replications.Plant to plant and row to row distance was kept 45 cm. and 15 cm. respectively. All the recommended agronomical practices were adopted to ensure good performance of Crop. Sufficient number of panicles were selected randomly and tagged at 50 per cent flowering. Then, the panicles were collected at random from the field at weekly intervals upto 6weeks (W_1 to W_6). The following seed quality estimations were performed to study the development and maturation for assessing the physiological maturity.An investigation was conducted to study the pattern of development and maturation under seed to seed method for fixing physiological maturity of seed. The results indicated that the panicle length reached its maximum value at second and fifth weeks after 50 percent flowering in seed to seed methods respectively.The panicle fresh weight was maximum, at first week after 50 per cent flowering in seed to seed method and there after it decreased.The panicle moisture content which was maximum immediately after flowering decreased with maturity. This was associated with an increase in dry weight of panicle which was maximum at fifth and sixth weeks after 50 percent flowering respectively in seed to seed method.The number of filled seeds and seed recovery percentage was maximum at fifth week in seed to seed method.The fresh weight of seed after reaching its maximum weight at third and fourth weeks respectively in seed to seed method decreased in later stages of ripening processes.A decrease in fresh weight was closely associated with a loss in moisture content of the maturing seed which reached the minimum of 37.0 and 35.4 percent respectively in seed to seed method at physiological maturity. The seed reached its maximum dry weight at third and fourth weeks after 50 percent flowering in seed to seed method.The shattering loss was more after physiological maturity i.e., at fifth and sixth weeks after 50 per cent flowering respectively in seed to seed method.The developing seed started to germinate at three weeks after 50 percent flowering under seed to seed method and reached the maximum germination at fifth and sixth weeks respectively.The seedling vigour in terms of root and shoot length, dry matter and vigour index attained its maximum values

only at fifth and sixth weeks, respectively in seed to seed method.The results of tiller wise seed quality studies revealed that the number of rachii/ panicle and panicle length, fresh and dry weight were more in the first formed (T_1) tillers compared to last formed tillers under seed to seed method. Similar trend was also observed for seed characters such as seed fresh and dry weight and germination and seedling vigour which decreased with late tillering. The seeds from T_6 did not germinate in the methods.
Key words: Guinea grass, Panicles, Physiological maturity, Seed yield, vigour

Introduction

Panicum maximum Jacq is native to tropical and subtropical regions and commonly known as guinea grass. It is one of the oldest grasses introduction to India in 1873.Guinea grass can grow in warm and humid conditions even up to 1800m msl. It tolerates the temperature range between 15ºC to 38ºC . The grass tolerates shade and grows under trees. It grows under a wide range of soils usually well drained conditions. It cannot withstand heavy clay and water logged conditions.Guinea grass is highly yielding, highly palatable and nutritious. The chemical composition of the variety Co1 reveals a high nutritive value of this grass species. It contains, 4.69% crude protein, 1.67% extractable ether, 37.33% crude fibre, 39.44% nitrogen free extract, 13.87% total ash and 7.08% minerals such as Ca (0.0517), P (0.24%), Mg (0.27%), Na (0.30%) and K (2.42%). Inspite of these merits, it could not get its right place in farmers fields due to poor establishment of the crop. Seed production and related studies in tropical forage crops face many problems and limitation than temperature species. It is mostly due to the inherent characteristics of the species which include non synchronization of flowering and maturity, production of less number of fertile seeds, low yield, low harvest index and heavy seed shattering. Flowering and seed setting largely depend upon the environmental conditions prevailing at the time of seed production. The stage of maturity is an important factor responsible for variation in viability and vigour. So the knowledge of seed maturity right from fertilization to maturity is a must for better management in terms of production of good quality seed. The area under forage crops is generally less and mostly for forage purpose. In this condition we have to utilize the available crop area for production of quality seed by proper cutting management and harvest. Most of the grass seeds posses poor germination because of the chaffy seeds in addition to that they have dormancy problem. Since the grass seeds being very small in size and strong occurrence of dormancy problems, requires a suitable media for germination to assess their viability potential. Similarly there is a need to assess the performance of dormant seed under normal storage conditions because the seeds produced in one year have to be stored properly for further use.

Material and Methods

A field experiment was carried out at the Organic Research Farm, Karguanji, Department of Seed Science and Technology, Institute of Agricultural Sciences, Bundelkhand University, Jhansi (U.P.) during kharif season, 2023-24. The experimental material was grown in a Randomized Block Design with three replications with seed development and maturation studies to fix the physiological maturity (Seed To Seed Method) in guinea grass cv.CO1.

T_1= Seed to seed (SS)- the crop was left for maturation as such with out cutting for forage ,T_2 = Seed one cut-seed (S_1 S)- The crop was given first cut at 50%flowering for forage and left as such for seed set, T_3=Seed two cut-seed (S_2 S)-The crop was given first cut at flowering and second cut after physiological maturity for forage and then allowed for seed set

Sufficient number of panicles were selected randomly and tagged at 50 per cent flowering. Then, the panicles were collected at random from the field at weekly intervals upto 6weeks (W_1 to W_6). The following seed quality estimations were performed to study the development and maturation for assessing the physiological maturity. The panicle and seed collected from different tillers of the plant were designated as T1, T2, T3, T4, T5 and T6.

Following characters, viz.,Number of rachii,Panicle length (cm),Weight of the panicle, Moisture content of the panicle, Number of seeds/panicle ,Weight of the seed, Moisture content of the seed ,1000 seed weight ,Germination ,Shoot length ,Root length ,Dry matter production and Vigour index .

The data collected from various experiments were analysed statistically adopting the methods described by Panse and Sukhatme (1967). Where ever necessary the percentage values were transformed into angular (Arcsine percentage) values before carrying out statistical analysis.

Results and Discussion

The panicles were collected at random from the field at weekly intervals upto 6weeks (W_1 to W_6).Number of rachii did not vary significantly among the stages of development and maturation .It ranged from 35(W3) to 37 (W4).A significant increase in length of panicle was observed from W1 (48cm) to W2 (49cm) and there after it remained unchanged. It declined from 3082 mg (W1) to 2514 mg (W5) with progressive stages of maturity.A slow and steady increase in dry weight of panicle was noticed from 1180 mg (W1) to 1420 mg (W5) indicating a significant increase during the period of development and maturation. The moisture content of panicle at W1 was 62.3 percent which decreased significantly to 43.5 percent in W5.With the stages of development and maturation of panicle, the number of seeds/panicle increased from 1519 (W1) to 1558 (W4).The number of filled seeds ranged from 263 (W3) to 621(W5).As the stage of maturity increased, it declined significantly from 1519 (W1) to 919 (W5).The recovery per cent increased with stages of maturity from 17 (W3) to 40 (W5).It showed a steady and significant increase over the period of seed development from 1946 mg (W1) to 2344 (W3). There after slight reduction was noticed.The seed dry weight was 958 mg at W1 which increased to1475 mg at W3.

There after it declined to 1433 mg at W5.The seed moisture content at W_1 was more (50.8percent) than that at W_5 stage (35.8 percent).The weight of 1000 seeds increased from W_1 stage (652mg) to W_3 stage (685mg) and afterwards a minimum decrease was registered.The highest percentage of seed shattering was observed in W_5 stage (78.4 percent) and the lowest in W_2 stage (8.34 percent). As the stage of maturity advanced the shattering loss also increased.The seeds started to germinate form W_3 stage onwards (12 percent) and reached maximum germination of 16 per cent at W_5 stage.

Shoot length varied from 3.5 cm (W_3) to 3.6cm (W_5) among the stages of maturity.The root length of the seedling was more at W_5 stage (2.8cm) compared to W_3 and W_4 (2.7cm).It ranged form 0.024 mg (10

seedlings) in W_3 to 0.025mg (10 seedlings) in W_5.A significant improvement in vigour index value was observed from 75 (W_3) to 103 (W_5).Time and method of harvest are important components of herbage seed production, because these can affect the quantity and quality of seed obtained. In this context, it would be beneficial to know at which stage of development the accumulation of dry matter in the seed terminates and the amount of seed lost by delayed harvest (Andersen and Andersen,1980).

Table 1:Studies on seed maturation and development seed to seed method on number of rachii, panicle length, fresh and dry weight, moisture content in guinea grass cv.CO1

Weeks	Number of rachii/panicle	Panicle length (cm)	Panicle fresh weight (mg)	Panicle dry weight (mg)	Panicle moisture (%)
W_1	36	48.0	3082	1180	62.3
W_2	36	49.0	2896	1226	57.6
W_3	35	49.0	2611	1281	52.3
W_4	37	49.0	2584	1387	46.3
W_5	36	49.0	2514	1420	43.5
Mean	36	49.0	2737	1299	52.4
CD (p=0.05)	NS	0.36	92.51	16.42	0.26

(Figures in parantheses indicated arc sine values)

Table 2.Studies on seed maturation and development in seed to seed method on number of seeds, number of filled and ill filled seeds and percentage of seed recovery in guinea grass cv.CO1

Weeks	Number of seeds/panicle	Number of filled seeds/panicle	Number of ill filled seeds/panicle	Seed recovery percentage
W_1	1519	-	1519	-
W_2	1547	-	1547	-
W_3	1550	263	1282	17.0
W_4	1558	457	1105	30.0
W_5	1545	621	919	40.1
Mean	1544	447	1249	28.9
CD (p=0.05)	21.49	4.13	4.13	0.18

(Figures in parantheses indicated arc sine values)

Table 3. Studies of seed maturation and development in seed to seed method on seed fresh, dry weight, moisture content,1000 seed weight and percentage of seed shattering in guinea grass cv.CO1

Weeks	Seed fresh weight/panicle	Seed dry weight/panicle	Seed moisture (%)	1000 seed weight (mg)	Seed shattering (%)
W_1	1946	958	50.8	651.7	-
W_2	2166	1121	48.0	675.1	8.3
W_3	2344	1475	37.0	684.8	27.6

W_4	2285	1454	36.4	680.8	75.0
W_5	2233	1433	35.8	676.7	78.4
Mean	2195	1288	41.7	673.8	47.3
CD (p=0.05)	5.21	4.46	0.15	1.94	0.28

(Figures in parantheses indicated arc sine values)

Table 4.Studies on seed maturation and development in guinea grass cv. CO1 in seed to seed method on germination, shoot and root length, dry matter production and vigour index.

Tiller	**Germination (%)**	**Shoot length (cm)**	**Root length (cm)**	**Dry matter Production (mg 10/ seedlings)**	**Vigour index**
W_3	12	3.5	2.7	0.024	75
W_4	14	3.6	2.7	0.025	92
W_5	16	3.6	2.8	0.025	103
Mean	14	3.6	2.7	0.025	91
CD (p=0.05)	0.0755	0.097	0.053	NS	4.7

(Figures in parantheses indicated arc sine values)

The panicle and seed collected from different tillers of the plant were designated as T1, T2, T3, T4, T5 and T6.

Number of rachii/ panicle Among different tillers, it ranged from 16 (T_6) to 26 (T_1).

Panicle length (cm) highly significant variations were observed among different tillers for panicle length. It decreased from 36, 6 cm (T_1) to 25.6 cm(T_6).Panicle fresh weight (mg) a significant decline in the panicle fresh weight was recorded from 2328 mg (T_1) to 869 mg (T_6). Panicle dry weight (mg) also decreased from 1338 mg (T_1)) to 1071 mg (T_6),Moisture content of panicle (**%)** Moisture content did not vary significantly.Number of seeds/panicle The seed number varied significantly among different tillers. It was maximum in T_1 (1032)and minimum in (T_5) (743).Fresh weight of seed/panicle Among tillers T_1 recorded maximum fresh weight (1613 mg) and T_5 the minimum weight (1299mg).Dry weight of seed/panicle was significantly different among tillers. The seeds were the heaviest in T_1 (1047 mg) and lightest in T_6 (340 mg).Seed moisture content (%) Non-significant differences were noticed for this parameter.1000 seed weight (mg) was significantly higher in T_1 (681.6 mg) than in T_5 and T_6 (677.6mg).Germination (%) of seeds among different tillers varied from 9 percent (T_1) to 5 percent in (T_5). The seeds from T_5 did not germinate. Shoot length (cm) the longest shoot was measured in T_1 (3.3.cm) and the shortest in T_5 (2.6cm).Root length (cm) the root length ranged from 2.5 cm ($T_4$and T_5) to 2.8cm (T_1).Dry matter production (mg) was more in T_1 (0.014 mg/5 seedlings) than in T_4 and T_5 (0.012) mg/5 seedlings).Vigour index Significant differences were noticed among the tillers. It ranged from 27 (T_5) to 57 (T_1).

The panicle length measured at weekly intervals after 50 percent flowering showed its maximum value at second and fifth weeks in the case of seed to seed methods, respectively. This findings is conformity with the results of Narayanaswamy (1994) in Deenanath grass.

The fresh weight of the panicle was maximum at first week after 50 percent flowering in both seed to seed method and there after a slow and steady decrease was noticed. This might be due to the loss of moisture which is the characteristic feature of the developing fruit or seed associated with the accumulation of food reserves and is due to desiccation and dehydration (Mayer,1963). In this investigation also ,the moisture content of the developing panicle which was maximum immediately after flowering decreased with advancing development and maturation. Several researches reported a gradual decrease in moisture content in a number of grass species.(Klein and Harmond,1971; Hill and Watkin,1975;Anderson,1980).

As reported above, the loss in moisture associated with an increase in dry weight of panicle which was maximum at fifth and sixth weeks after 50% flowering respectively in seed to seed method. Similar increase in dry weight of fruits /panicle with increase in stage of development was reported by Narayanaswamy (1994) in deenanath grass.

Table 5.Influence of tiller under seed to seed method on number of rachii, panicle length, fresh and dry weight, moisture content in guinea grasscv.CO1

Tiller	**Number of rachii/panicle**	**Panicle length (cm)**	**Panicle fresh weight (mg)**	**Panicle dry weight (mg)**	**Panicle moisture (%)**
T_1	26	36.6	2328	338	42.7
T_2	25	35.4	2225	1284	42.5
T_3	23	33.6	2142	1226	42.6
T_4	22	30.5	2029	1157	42.9
T_5	19	27.6	1970	1125	42.9
T_6	16	25.6	1869	1071	42.5
Mean	22	31.6	2094	1200	42.69
CD (p=0.05)	1.17	0.38	23.22	11.54	NS

(Figures in parantheses indicated arc sine values)

Table 6. Influence of tiller under seed to seed method on number of seeds, seed fresh and dry weight, moisture content and 1000 seed weight in guinea grass cv.CO1

Tiller	Number of seeds/panicle	Seed fresh weight/panicle (mg)	Seed dry weight/panicle (mg)	Seed moisture (%)	1000 seed weight (mg)
T_1	1032	1613	1047	35.0	681.6
T_2	994	1542	997	35.4	681.6
T_3	940	1516	984	35.1	680.2
T_4	865	1438	928	35.4	678.6
T_5	805	1362	880	35.6	677.5
T_6	743	1299	840	35.3	679.6
Mean	896	1462	946	35.3	679.4
CD (p=0.05)	30.68	16.33	11.45	NS	0.709

(Figures in parantheses indicated arc sine values)

Table 7.Influence of tiller under seed to seed method on germination, shoot and root length, dry matter production and vigour index in guinea grass cv. CO1

Tiller	Germination (%)	Shoot length (cm)	Root length (cm)	Dry matter production (mg 5/seedlings)	Vigour index
T_1	9	3.3	2.8	0.014	57
T_2	9	3.2	2.6	0.013	54
T_3	8	3.0	2.6	0.013	51
T_4	7	2.8	2.5	0.012	38
T_5	5	2.6	2.5	0.012	27
T_6	-	-	-	-	-
Mean	8	3.0	2.6	0.013	45
CD (p=0.05)	1.388	0.137	0.076	0.0011	8.683

(Figures in parantheses indicated arc sine values)

In the study, panicle characters such as number of rachii, length, fresh weight and dry weight of the panicle were more in the first formed tillers (T_1) compared to last formed tillers (T_6) under seed to seed method. The similar trend was also observed for seed characters such as fresh and dry weight of seed per panicle. Germination and seedling vigour in terms of root and shoot length, dry matter production and vigour index were higher in early formed tillers (T_1) which decreased with delaying tillering. The values were lower in T_5.

The seeds from T_6 did not germinate in the methods. Similar differential variation in panicle and seed characters was observed in the different tillers of tropical grasses (Hill, 1980; Booman, 1980; Mc willium, 1980). Anslow (1964) reported that the final weight attained by an individual seed is dependent upon its position With in the ear and the age of the tiller seed weight per ear decreasing with later date of ear emergence. This variation may be mainly due to competition between and with in plants for light, water and nutrients. According to Nikitenko (1968), the process of formation of generative organs and the accumulation of reserve material is closely correlated with intensity of photosynthesis in the leaves and the flow of assimilates to the reproductive organs. Differences in seed germination and seedling vigour between ear heads of a plant in bajra (Ayyangar and Hariharan ,1935; Sankaran et al., 1967) between different parts of spike in wheat (Hardesty and Elliot, 1956) or cob in maize (Ivanch,1963) and different parts of cotton plant (Naziror, 1958) (or) carrot plant (Hawthorn et al., 1966). Biochemical variability is frequently observed in fully matured seed formed in different parts of the generative organs (Ovcharov, 1969). Hardesty and Elliot (1956) observed that the first seed in a development sequence may have a competitive advantage over the later formed seeds in the sequence.

In this investigation acid scarification for 10min. duration was optimum in enhancing the germination and seedling vigour in guinea grass. Similar results were reported by Burton (1939) in bahia grass seed by increasing the germination due to sulphuric acid treatment for 5 minutes, Brecke and Duke (1980) in Fall panicum by increasing the germination due to acid scarification for 8min. and Tischler et al. (1993) in switch grass due to 10 min. acid scarification improved the germination. This may due to the removal or disruption of lemma and palea may allow greater as exchange or water movement into the seed for partial destruction or removal of specific germination inhibitors present in freshly harvested seed.

The results obtained from this experiment clearly suggest that harvesting stage has significant effect on seed yield and quality in the grass. Timing of harvest is very important , delay in harvesting results in shedding of seeds and early harvesting contributes to more number of immature seeds in a seed lot.

References

Abdul-Baki, A.A. and J. D. Anderson. 1973. Vigour determination in soyabean seed by multiple criteria. Crop Sci.,13;630-633.

Andersen, S. 1980. Increase in dry matter and decrease in moisture content during ripening of the seed cereals and grasses Seed production' pp 171. Edt. Hebbelthwaite, 1980. Publi. Buttersworth, London.

Andersen, S. and K. Andersen. 1980. The relationship between seed maturation and seed yield in grasses"Seed production"pp151-171 Edt. Hebblethwaite, 1980. Publi, Butters Worth, London.

Anslow, R.c. 1964. "Seed formation in perennial rye grass II. Maturation of seed" .J. Br. Grassland Soc.,19:349-357

Ayyanar, G.N.R .and P.V. Hariharan. 1935. The tillers of pearlmillet. Madras Agric. J., 23:474-477.

Boonman, J. G. 1980. Seed production of tropical grasses in Kenya. Seed production pp218-227. Etd .Hebblethwaite, Publ. Butters worth, London.

Brecke, B.J, and W. B. Duke. 1980. Dormancy, germination and emergence characteristics of fall panicum (Panicum dichotomiflorum) seed. Weed Sci.28:683-685.

Burton, G.W. 1939. Scarification studies on southern grass seeds .J. American Soc.Agron.,31;179-187.

Hardesty, B. and F.Elliot.1956.Differential post-ripening effect among seeds from the same parental wheat spine.Agron.J.,48:9.

Hawthoyn, L.R., E.H. Toole and V.K. Toole. 1966. Yield and variability of carrot seeds as affected by position of umbel and time of harvest. Proc. Amer. Soc. Hort. Sci., 80:401.

Hill, M.J. 1980. Temperature pasture grass seed crops formative factors. Seed production, pp141-149. Etd. Hebblethwaite, 1980. Publ. Buttersworth, London.

Ivanch, A. 1963. Effect of the conditions of seed formation and storage on germination. Asquoted by K.E. Ovcharoz. 1977. Physiological basis for seed germination, Amerind Publishing Co. Pvt. Ltd. New Delhi.

Klein, L. M. and J.E. Harmond. 1971. Seed moisture a harvest index for maximum yield. Trans ASAE,14:124-126.

Mayer, A.M. and Mayer, A.P. 1963. The germination of seeds pergaraon press, Oxford, p.101-156.

Mc Willium, J.R. 1980. The development and significance of seed retension in grasses. Seed production, pp51-60. Etd. Hebbelethwaite 1980, Publ.Butterworth, London.

Narayanaswamy, S. 1994. Seed Technological studies in Deenanath grass. M.Sc. (Ag.) Thesis, Department of seed Tech., TNAU, Coimbatore.

Nazirov, I. 1958, Peculiarity of seed germination in cotton seeds of different maturity as queoted by Orcharov, K.E. 1977. Physiological basis of germination, Amerind Publishing Co. Pvt. Ltd., New Delhi.

Nikitenko, G. 1968. Biological basis of seed protection of green crops. Asquoted by Ovcharov, K.E.1977.Physiological basis of seed germination Amerind Publ. Co. Pvt. Ltd. New Delhi.

Ovcharov, K.E. 1969. The physiology of different quality seeds. Proc. Int. Seed Test Ass.,34:305-313.

Tishcler, C.R., B.A. Young and S Anderson. 1994. Techniques for reducing seed dormancy in switch grass. Seed SciTech.,22:19-26.