Identification of Elite Cultivars in Maize (Zea mays L.) Germplasm Based on Agronomical Characters

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INTRODUCTION

Maize (Zea mays L.) is the largest crop in the world and the first cereal produced front of wheat, with a production of 843 million tons in 2014, against 653 million tons for wheat.[1] In Benin corn, is also the most cultivated cereal, and holds first place with nearly 70% of cereal area planted. In southern Benin, it is the staple food with a consumption of forms of diversity (fresh corn, roasted corn, corn dough patty). Its production is estimated at over 900,000 tons, accounting for about four-fifths of the national cereal production. Despite the favorable conditions enjoyed by the culture, he knows an evolution saw tooth;[2] although the research conducted in recent years have led to the development of improved varieties, some of which are already popular;[3] it must be noted that these improved varieties are very few adopted by the producers for several reasons including their requirements in specific input and technological and organoleptic qualities that do not always meet the needs of users.[4-6] Thus, there arises the need to highlight some local maize varieties that stand out from other varieties and meet the requirements of producers and consumers. Moreover, in the current highly unstable agroclimatic conditions, it is urgent to screen varieties/ecotypes to highlight the best performers. This study aims to evaluate the performance of 10 varieties of maize in agroecological conditions of South Benin, to identify the best.

Study Site

The experiment was conducted from 29 May to 12 September 2014 at the experimental site of Faculty of Agricultural Sciences of the UAC to Sekou (town of Allada) (2°19’E, 6°12’N), located at 50 km north of Cotonou. The climate is subequatorial with two rainy seasons and two dry seasons. There is an average 1200 mm of water for about 85 days of rain per year. The average temperature varies between 27 and 29°C with relative humidity averaged 70%. The vegetation is of Guinean. The soil, commonly known as earth bar, is ferralitique kind desaturated to kaolinite.

MATERIAL AND METHODS

Plant Material

The plant material used as part of our work is exclusively maize. Table 1 present the 10 local varieties used and their characteristics.

Methods

Sampling design

The experimental design is a randomized block Fisher with four repetitions, of which 10 treatments...
(10 varieties of corn) namely Massahouégontinwéwé, Massahouégontivé, Lagos, Carder, Massahouéwéwé, Massahoué, Massahouéwéwé, Massahouéwéwé, Massahouéwéwé, Massahouéwéwé, used in this study. Land dimensions are 3-1.2 m. The spacing between planting holes is 0.4 m × 0.8 m and the spacing between lines is 0.8 m. He alleys between elementary repetitions and pieces are, respectively, 1 and 0.6 m.

Cultural operations, measured parameters, and data collected

The test site was mowed and plowed flat, then fertilized by the intake of 78 g a mixture of triple super phosphate and 98 g K₂O per basic plot as basal dressing. The sowing took place after soil preparation and basal dressing at 2 grains by seed hole. The first weeding and hoeing the second held, respectively, 15 and 45 JAS JAS. The plants were thinned to 46 JAS stage five sheets; then a urea intake of 36 g by elemental plot was made. The harvest took place 107 days after sowing.

The following actions were taken: Plant height, length of plant, plant width, circumference collar, male flowering female flowering, branching away from the panicle, number of primary branch of the panicle, panicle length, number of ears by foot, ear insertion height, leaf number above the ear, spike length, diameter of the spike, plant height, circumference of the collar of the adventitious root, maturity, number of stored grain, average grain, weight of 100 grains, grain color, grain length, grain width, grain diameter, according to the descriptors of maize.

Statistical Analysis of Data

Statistics 8 software was used for analysis of variance (ANOVA) to compare means using the least square difference test at the 5% threshold. A descriptive statistical analysis was conducted to investigate the differences between the coefficients of variation for the characters semi-cycle of flowering and plant maturity, while the variance analysis focused on the characters number of primary branch of the panicle, number of ear per plant, height of insertion of ear and plant height. Minitab the software has achieved the matrix correlation.

RESULTS

Qualitative Character Analysis in Prospective Areas

The color of the grains presents a variation on all 10 varieties. White corn grains account for 50%. They are cultivated in the areas surveyed than yellow corn (40%) and red corn (10%) (Table 2).

The distribution of maize accessions according to color silk tassel and color shows through against 70% are green and 30% are purple (Table 3).

Descriptive Analysis of Quantitative Traits

Significant differences were observed between the minima and maxima for important agronomic traits such as male flowering (FLOM), silking (FLOF), the height of plant (HP),}

<table>
<thead>
<tr>
<th>Name of the cultivar</th>
<th>Cycle according to the producer</th>
<th>Ethnic group</th>
<th>Status of the sample</th>
<th>Sample origin</th>
<th>Frequency</th>
<th>Resistance to the dryness</th>
<th>Vermin resistance in stock</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massahouégontinwéwé</td>
<td>2 months ½</td>
<td>Goun</td>
<td>Cultivar of the territory</td>
<td>Garret</td>
<td>Abundant</td>
<td>No</td>
<td>Average</td>
<td>Yellow</td>
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<td>Massahouégontivé</td>
<td>3 months ½</td>
<td>Goun</td>
<td>Cultivar of the territory</td>
<td>Garret</td>
<td>Abundant</td>
<td>Average</td>
<td>Average</td>
<td>Yellow</td>
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<td>Lagos</td>
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<td>Goun</td>
<td>Imported</td>
<td>Garret</td>
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<td>Average</td>
<td>Bad</td>
<td>Red</td>
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<tr>
<td>Cader</td>
<td>2 months ½</td>
<td>Goun</td>
<td>Improved</td>
<td>Garret</td>
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<td>Maid</td>
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<td>Maid</td>
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<td>Cultivar of the territory</td>
<td>Garret</td>
<td>Abundant</td>
<td>Maid</td>
<td>Average</td>
<td>White</td>
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<td>Nago</td>
<td>Cultivar of the territory</td>
<td>Garret</td>
<td>Frequent</td>
<td>Maid</td>
<td>Maid</td>
<td>White</td>
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<td>Goun</td>
<td>Cultivar of the territory</td>
<td>Garret</td>
<td>Frequent</td>
<td>Maid</td>
<td>Maid</td>
<td>White</td>
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<tr>
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<td>Goun</td>
<td>Cultivar of the territory</td>
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<td>Maid</td>
<td>Average</td>
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<tr>
<th>Character analysis</th>
<th>Colors</th>
<th>Katagon</th>
<th>Zoungbomin</th>
<th>Ifangni centre</th>
<th>Total</th>
<th>Frequencies (%)</th>
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<tr>
<td>Grains color</td>
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<td>1</td>
<td>1</td>
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<td>40</td>
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<td></td>
<td>Red</td>
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<td>0</td>
<td>0</td>
<td>1</td>
<td>10</td>
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<td></td>
<td>White</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>50</td>
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<td>Total</td>
<td></td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>10</td>
<td>100</td>
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</table>
number of grain rows (NRG) the average number of kernels per row (NMGR), weight of 100 grains (P100G) (Table 4). On average, accessions have a 50-day semi-flowering cycle. The earliest began his male flowering from 47 days after sowing and later to 52 days. Silking varies from 51 days to the earliest and 55 days later. The plant height varies from 131.65 cm for small varieties to 149.35 cm for tall varieties, with an average of 142.05 cm. The weight of 100 grains varies from 21.075 g for accessions with small grains to 28,300 g for those coarse.

Table 5 obtained after the ANOVA, it appears that Massahouéwéwé over primary branch (20.57), Massahoué has the number of the lowest primary branch (13.5). Massahouégontinwéwé and Massahouégontivé (2.250) have more ears while Massahouévèvè (1.250) fewer ears. Regarding the insertion height of the ears Massahouégontivé has the greatest height (87.50 cm) and the lowest Massahouéwéwé height of insertion of the ears (62 cm), with a significant difference at alpha 5% threshold.

Structuring of Morphological Diversity

A significant correlation (≥0.50) was observed between several pairs of variables (Table 6). Positive relationship between the circumference of the collar, branching away from the tassel, height insertion ears, the maturity and the number of row of grain with height plant which implies that an increase in plant height causes an increase of all these variables. Hence, the tall cultivars are late, have a good ear insertion height and a good circumference collar.

Analyze Differences between Flowerings

From descriptive analysis (Table 7), the coefficient of variation is low (<15%) for most of the measured variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>X</th>
<th>Max</th>
<th>Min</th>
<th>SD</th>
<th>CV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circumference (cm)</td>
<td>5.6453</td>
<td>6.3000</td>
<td>5.0700</td>
<td>0.5876</td>
<td>20.82</td>
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<td>L (cm)</td>
<td>59.342</td>
<td>69.410</td>
<td>46.155</td>
<td>8.9551</td>
<td>30.18</td>
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<tr>
<td>FLOF (jrs)</td>
<td>52.800</td>
<td>55.000</td>
<td>51.250</td>
<td>2.42447</td>
<td>9.18</td>
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<tr>
<td>DRP (cm)</td>
<td>11.805</td>
<td>13.065</td>
<td>10.560</td>
<td>1.0272</td>
<td>17.40</td>
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<td>LP (cm)</td>
<td>33.195</td>
<td>35.270</td>
<td>31.395</td>
<td>1.7938</td>
<td>10.81</td>
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<td>HPL (cm)</td>
<td>142.05</td>
<td>149.95</td>
<td>131.61</td>
<td>8.4042</td>
<td>11.83</td>
</tr>
<tr>
<td>NFE</td>
<td>5.6700</td>
<td>6.0500</td>
<td>5.4000</td>
<td>0.2539</td>
<td>9.03</td>
</tr>
<tr>
<td>CAR (cm)</td>
<td>5.5235</td>
<td>5.8700</td>
<td>4.9850</td>
<td>0.2565</td>
<td>9.29</td>
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<td>Mat (jrs)</td>
<td>115.83</td>
<td>99.00</td>
<td>91.00</td>
<td>63.903</td>
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<td>LE (cm)</td>
<td>107.68</td>
<td>121.35</td>
<td>96.51</td>
<td>8.8042</td>
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<td>DE (cm)</td>
<td>34.590</td>
<td>35.859</td>
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<td>13.35</td>
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<td>NGR</td>
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<td>12.700</td>
<td>11.150</td>
<td>0.7082</td>
<td>6.01</td>
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<tr>
<td>NMGR</td>
<td>23.980</td>
<td>26.650</td>
<td>20.600</td>
<td>2.4079</td>
<td>20.08</td>
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<tr>
<td>P100G (g)</td>
<td>24.815</td>
<td>28.300</td>
<td>21.075</td>
<td>2.4619</td>
<td>19.84</td>
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<tr>
<td>DG (cm)</td>
<td>4.5242</td>
<td>4.7100</td>
<td>4.1985</td>
<td>0.4263</td>
<td>18.84</td>
</tr>
<tr>
<td>LG (mm)</td>
<td>9.3027</td>
<td>9.5900</td>
<td>8.5845</td>
<td>0.5276</td>
<td>11.34</td>
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<tr>
<td>IG (mm)</td>
<td>8.6004</td>
<td>8.9910</td>
<td>7.8650</td>
<td>0.4368</td>
<td>10.16</td>
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</tbody>
</table>

X: Average, Max: Maximum value, Min: Minimal value, SD: Standard of deviation, CV: Coefficient of variation, FLOM: Male flowering, FLOF: Silking, HP: Height of plant, NRG: Number of grain rows, NMGR: The average number of kernels per row, P100: Weight of 100 grains
which confirms the precision of the test. Furthermore, significant differences were recorded between the averages for some varieties. The differences in the days of the appearance of flowering male and female flowering is 2.75 days for varieties Lagos Carder with respective maturities of 91 and 90 days. The coefficients of variation are <10% for the three traits studied.

Analysis of Yield Components Varieties Lagos and Carder

Table 8 presented the coefficients of variation of some performance parameters for varieties Lagos Carder. It appears from this table that the average values of all the parameters vary very little from one variety to the other with the exception of the length of the ear, where there is a significant difference of 10.13 mm. The coefficient of variation is low (<5%) for all variables.

Variations Height of the Various Varieties during the Test

The differences between the heights of the varieties Lagos and Carder vary from 1.77 cm to 9.36 cm, respectively, from 25 to 70 JAS (Figure 1).

Table 5: Change in the number of primary branches, number of cob by foot and height insertion ears

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Numbers of primary branch of the panicle</th>
<th>Number of ears per seedling</th>
<th>Height of insertion of ears (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>18.650a^b</td>
<td>2.250a</td>
<td>81.000a^b</td>
</tr>
<tr>
<td>T2</td>
<td>16.050a^b</td>
<td>2.250a</td>
<td>87.500a</td>
</tr>
<tr>
<td>T3</td>
<td>15.300a^b</td>
<td>1.750a^b</td>
<td>78.050a</td>
</tr>
<tr>
<td>T4</td>
<td>15.450a^b</td>
<td>1.500a</td>
<td>71.700a</td>
</tr>
<tr>
<td>T5</td>
<td>14.850a^b</td>
<td>2.000a^b</td>
<td>75.850a^b</td>
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<td>T6</td>
<td>13.500a^b</td>
<td>1.750a^b</td>
<td>70.380a</td>
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<td>T7</td>
<td>20.575a^b</td>
<td>2.000a^b</td>
<td>62.000a</td>
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<tr>
<td>T8</td>
<td>17.400a^b</td>
<td>2.000a^b</td>
<td>72.600a</td>
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<tr>
<td>T9</td>
<td>15.200a^b</td>
<td>2.000a^b</td>
<td>72.600a</td>
</tr>
<tr>
<td>T10</td>
<td>18.125a^b</td>
<td>1.250a</td>
<td>72.950a^b</td>
</tr>
<tr>
<td>P</td>
<td>0.03*</td>
<td>0.0265*</td>
<td>0.022*</td>
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<tr>
<td>LSD</td>
<td>6.9761</td>
<td>0.5746</td>
<td>24.656</td>
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Table 6: Correlation matrix of the studied characters

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<th></th>
<th>HP</th>
<th>CirC</th>
<th>LF</th>
<th>IF</th>
<th>FLOM</th>
<th>FLOF</th>
<th>DRP</th>
<th>LP</th>
<th>NBP</th>
<th>NEP</th>
<th>HIE</th>
<th>NFE</th>
<th>Mat</th>
<th>LE</th>
<th>DE</th>
<th>NGR</th>
<th>NMGR</th>
<th>P100</th>
<th>LG</th>
<th>IG</th>
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<td>0.83</td>
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<td>0.68</td>
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* indicates significant difference

FLOM: Male flowering, FLOF: Silking, HP: Height of plant, NRG: Number of grain rows, NMGR: The average number of kernels per row, P100: Weight of 100 grains
Table 7: Change in flowering cycles and maturity

<table>
<thead>
<tr>
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<th>LE</th>
<th>DE</th>
<th>NMGR</th>
<th>NRG</th>
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<td>12.20</td>
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<tr>
<td>T2</td>
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<td>5.065</td>
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<td>3.75</td>
<td>2.62</td>
<td>2.09</td>
</tr>
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</table>

Table 8: Change in components of yield varieties Lagos and Carder

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<th>DE</th>
<th>NMGR</th>
<th>NRG</th>
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<tbody>
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<td>4.35</td>
<td>3.75</td>
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</tbody>
</table>

Variations Height of the Varieties Lagos and Carder

Figure 2 presents the evolution height of the seedlings according to time. It arises that the difference between the Lagos varieties and to card is increasing 1.76, 4.08, 7.14, respectively, to 25, 35, 45 JAS. In addition, the difference in height observed with 70 JAS which is 2.40 cm show a reduction of the differences between height seedlings after flowering.

DISCUSSION

In the plan agromorphological, local accessions of corn grown in the Department of Ouémé in Benin revealed significant differences between the characters analyzed, indicating a strong phenotypic heterogeneity between 10 accessions. This morphological diversity was structured into six groups that differ in plant height, the semi-flowering cycle, the number of stored grain, the average number of kernels per row and weight of 100 grains. These characters have helped distinguish the early and intermediate groups corn, midsize, late corn and groups large and imposing corn morphologically. Similar results were obtained by Attiey [7] in Ivory Coast and to suggest that morphological differentiation is often based on agronomic traits. The large differences between the minimum and maximum values for all analyzed morphological characters show significant inter-variability accessions. This strong result morphological diversity of peasant seed management practices. The country phenotypical selection based on the characters perceptible (phenologic, vegetative, and ear) could explain the contribution of these variables to the structuring of variability.

A weak variation enters the averages of the varieties Carder and Lagos with a coefficient of variation lower than 10%. The transition from the male inflorescence to the female inflorescence occupies an interval of time from 2 to 4 days. These results are in conformity with those of Fleury, which supports that the necessary interval between male flowering and female flowering is lower than 5 days. The variations of days of appearance between male flowering and female flowering are 2.75 days for the varieties Lagos and Carder. More the shift between flowerings male and female is significant, less the material considered flowers in a synchronous way. This interval is influenced by the hydrous stress. The difference between flowerings male and female is very significant in improvement varietal because it directly influences the fecundation of the female flowers and thus the formation of grains. Moreover, the dryness is responsible for an increase in the difference between male and female flowering. Our results are similar to those of Sanou [8] which undertook a study on the performance of the S2 lines of FBC6 compared to the hydrous stress. It observed a shift between flowerings male and female. On the other hand, our results are contrary with those of Zoma [9] which undertook a study on the S1 lines of HOPE and showed that there is no significant difference between the lines compared to the shift between male and female flowering.

During this study, the varieties Lagos and Carder were identified by the variations reduced between the dates of male and female flowering, and their maturity rather short early (90 days). Indeed the test knew 32 days without rain, covering the significant stages of flowering.
In spite of this condition of hydrous stress, the variations of days between the appearances of flowers male and female remained lower than 4.5 days for all the studied varieties, and 2.75 days for the varieties Lagos and Carder. This testifies to the aptitude of the varieties to tolerate the dryness in period of irregularity of the rains. Moreover, according to our investigations, the Carder variety would be initially variety enhanced vertical deepwater tree, introduced into the zone approximately 15 years ago.

CONCLUSION

The preliminary results on the diversity and the morphological characterization of corn cultivated in Ouémé clearly show that the different one are varieties tested present a variation for the whole of the characters used, in particular, those related to the cycle of semi-flowering, with the height of the plant, the number of lines of grain, the average number of grains per line and with the weight of 100 grains. This genetic variability observed between accessions constitutes an asset for work of selection. The differences observed between the varieties indicate that the varieties Lagos (P100G 24.42; NMGR 26.40; NRG 12.20; FLM 47.75; FLF 50.50) and Carder (P100G 25.57; NMGR 25.05; NRG 11.70; FLM 48.50; FLF 51.25), introduce no nearly but intermediate individuals. They are essential morphologiquement with ears inserted into low height (HIE Lagos 78.05 cm; to card 71.05 cm). The Lagos varieties and to Carder have the best characteristics of ear and grains and can be used as source of parents to improve the output. These two varieties are equipped with the best vegetative characteristics and could be proposed to the producers in these times of climatic changes.

REFERENCES


Author Queries???
AQ1: Kindly provide department
AQ2: Kindly provide structured abstract
AQ3: Kindly provide history details
AQ4: Kindly provide runing title
AQ5: Kindly review the sentence.
AQ6: Kindly check the abbreviation and expansion
AQ7: Kindly provide complete reference details
AQ8: Please note three references seems to be combined as single reference. Kindly suggest whether to delete the latter or not.
AQ9: Kindly check the edit throughout the file.
AQ10: Kindly provide significant values