ABSTRACT

Groundnut is the most important pulse crop in East Nusa Tenggara (ENT); however, the crop yield in ENT is low due to erratic climatic condition, drought stress, and low yielding ability of most cultivated genotypes. Local Rote is a well-known local groundnut variety in ENT, which is a potential superior variety and parental source due its large seed size and high yielding ability. Information on its resistance to abiotic and biotic stresses is important for its future development. Five groundnut genotypes, Local Rote and check varieties were elucidated to identify drought resistant genotypes. The study was carried out in a split-plot design with three replicates in two locations during dry season 2013. Two irrigation regimes (optimum and stress conditions) were assigned as main plot and 5 groundnut genotypes as sub-plot. Research results revealed significant effect of irrigation by genotype interaction on observed yield and yield component characters in both locations. Seed yields of most tested genotypes were below their yield potential. Local Rote yielded best over two locations (1.26 t.ha\(^{-1}\) seed yield). Yields of check varieties were below 1.0 t.ha\(^{-1}\). Local Rote was considered tolerant to drought based on STI, GMP, SSI and YL selection indices.

Keywords: drought, groundnut, local, tolerance, variety

INTRODUCTION

Groundnut (Arachis hypogaea L.) is the second most important pulse crop in Indonesia, and the most important one in East Nusa Tenggara (ENT) Province. It is an important oil seed crop as well as food and feed crop.
of local germplasm of ENT Province as well as available check/released varieties. 

Local Rote variety was identified to be high yielding and widely adapted to agro climatic conditions of ENT province (Ndiwa et al., 2011). However, farmer-level productivity of this local groundnut genotype is still below its yield potential due to erratic climatic condition and poor farming practices. Among these, erratic climatic condition and drought stress are the main constraints for crop production. Development of high yielding varieties having tolerance to drought stress is the best solution for this problem. One of the main goals in breeding programs is selection of the best genotypes under drought stress conditions (Richards et al., 2002).

Water deficit, commonly known as drought, can be defined as the absence of adequate moisture necessary for normal plant growth and to complete the life cycle (Zhu, 2002). A number of selection indices have been proposed to determine drought tolerance in many crop species, including stress tolerance index (STI) (Fernandez, 1992), stress susceptibility index (SSI) (Fischer and Maurer, 1978), percent yield loss (YL) (Blum, 1980), and geometric mean productivity (GMP) (Golbashy et al., 2010). Some researchers found that cultivars which had the lowest SSI values were more drought resistant than cultivars with highest SSI values (Sio-Se et al., 2006; Bahar and Yildirim, 2010). On the other hand, cultivars which had high STI values were drought tolerant and those with low STI values were drought susceptible. Golbashy et al. (2010) found that STI and GMP indices have similar ability to separate drought sensitive and tolerant genotypes, which are in line with observation by Sio Se et al. (2006). These indices, therefore, can also be employed to select high yielding and drought tolerant groundnut genotypes, specifically adapted to semi arid climatic condition of ENT province. Therefore, it is necessary to identify selection indices able to distinguish high yielding and drought tolerant groundnut cultivars in drought stress and in non stress (normal) conditions. The present study was carried out to determine yield potential of local Rote and four check/released groundnut varieties and 2) to determine drought tolerance level of the tested groundnut genotypes.

MATERIALS AND METHODS

Site Description and Research Design

This research was carried out in the farmer’s field in two locations, i.e. Naioni Village in Kupang District, West Timor and Takeme Village in Rote Ndao District, Rote Island, during dry season 2013 (June to October 2013). Research site at Kupang was located at about 260 m above sea level (asl) and that in Rote was located at about 112 m asl. Soil type of both locations was Vertisol (Grumosol: USDA). A split plot design was employed in each location, consisting of irrigation regime as the main plot and groundnut genotype as sub-plot treatments. Irrigation regime was of two levels, i.e. normal (optimum) condition (I₀) and minimum/stress condition (I₁). In both stress and normal conditions, the plants were irrigated once a day during the first one week after planting until field capacity level, followed by two days interval irrigation until flowering stage. Irrigation treatments were applied at the flowering stage until two weeks before harvest. In normal condition the plants were irrigated once in four days while in the stress condition, the plants were irrigated once in 10 days. Irrigations in 4 and 10 days intervals for normal and minimum/stress conditions, respectively, were based on calculated water loss through evapotranspiration employing mean E_t values in the research areas during the last five years (5.23-5.25 mm.day⁻¹ during June to September) and groundnut plant coefficient during the flowering and reproductive stage (1.1). Using this approach, the plants grown under minimum/stress condition were expected to experience water stress during the treatment period. Soil water content analysis showed that soil water levels at the end of each treatment period for normal condition ranged from 84-88% field capacity level while that of minimum/stress condition ranged from 44-52% field capacity level. In the sub-plot treatment, five groundnut genotypes were included, consisting of 4 check varieties from Research Institute of Pulse and Tuber Crops (Balitkabi), Malang, i.e. Gajah, Jerapah, Kancil, Bison, and one local variety, Local Rote. All treatments consisted of three replicates, and in total, 30 experimental units were observed in each location.
Crop Management

After land preparation, the groundnut genotypes were grown in a planting space of 50 cm x 40 cm in plots of 3 m length and 2 m width. The space between the plots was 1 m. Two seeds were planted in a planting hole, and a total of 60 seeds were planted in each plot. Field plots were subjected to normal agronomic practices except irrigation treatment that was applied at flowering stage (about one month after planting for all tested genotypes). Fertilizers were applied at sowing time with a composite fertilizer (36% P$_2$O$_5$, 36% N and 36% KCl) at a rate of 100 kg.ha$^{-1}$).

Observation and Data Analysis

The variables observed in this experiment included days to flowering, days to harvesting, number of pod per plant, number of seed per pod, 100-seed dry weight and seed dry weight per plot. Seed dry yield per plot was used to assess drought tolerance level based on the following indices (Fischer and Maurer, 1978; Blum, 1980; Fernandez, 1992; Sio-Se et al., 2006).

\[
\text{Stress Tolerance Index (STI)} = \frac{Y_pY_s}{(Y_p)^2} \\
\text{Stress Susceptibility Index (SSI)} = 1 - \left(\frac{Y_s}{Y_p}\right) \\
\text{Yield Loss (YL)} = \left(\frac{(Y_p-Y_s)}{Y_p}\right) \times 100\% \\
\text{Geometric Mean Productivity (GMP)} = \sqrt{(Y_p)(Y_s)}
\]

Where $Y_s$ and $Y_p$ are stress and non-stress (potential) yield of a given genotype, respectively. $Y_s$ and $Y_p$ are average yields of all genotypes under stress and non-stress conditions, respectively. Data were recorded from 20 sample plants in each plot and were subjected to variance analysis appropriate for split plot design using Gentstat ver. 12 software's. Means were compared using Duncan's Multiple Range Test at 0.05 level of probability when F test is significant. Correlation analysis was also carried out among drought stress indices employed.

RESULTS AND DISCUSSION

Growth Component Variables

Irrigation treatment was applied about one month after planting, at which most of the genotypes were at the flowering stage. In both locations, data analysis revealed no significant effect of genotype by irrigation interaction on days to flowering but the single factor, genotype, posed highly significant effect on the trait indicating that days to flowering were mainly controlled by genetic factor. Similarly, no significant genotype by irrigation interaction effect was observed on days to harvesting but the genotype factor alone posed significant effect on this trait in both Kupang and Rote. Two check varieties, i.e. Gajah and Kancil exhibited a shorter flowering days than other genotypes while Local Rote exhibited the longest flowering date (Table 1). The check variety, Jerapah, exhibited a shorter harvesting date in both locations but was not substantially different from that of the other three check varieties in Rote. As with the flowering dates, the harvesting dates of Local Rote were the longest in both Kupang and Rote (133.5 and 135.67 days, respectively) indicating its longer generative period, and hence, longer period of pod formation and pod filling.

Harvesting date of the four check varieties ranged between 107.5 and 109.33 days, which were about three weeks earlier than Local Rote genotype (Table 1). The longer harvesting date, and hence the longer generative period, of the local Rote genotype was due to genetic factor, where this local genotype is a semi-determinate plant type with a more and longer branching pattern. Pod formation of this local genotype was also distributed along the plant branches. The four check varieties, on the other hand, are determinate types with erect and enclosed branching and close clustered pod formation at the plant main stem.

As with genotype treatment, the single factor irrigation treatment also caused significant effect on days to harvesting in Kupang but caused no significant effect on the same trait in Rote. In Kupang, average days to harvesting of the five genotypes exposed to water stress condition (112.6 days) was earlier than the optimum/normal irrigation (no stress) condition (113.6 days). This implies that water stress condition has imposed the tested groundnut genotypes to shorten their growth and development period and hence, a shorter harvesting date.
Table 1. Days to flowering and days to harvesting of the tested groundnut genotypes under two irrigation regimes in two locations

| Genotype  | Days to flowering | Days to harvesting |
|-----------|-------------------|--------------------|
|           | Kupang            | Rote               | Kupang            | Rote               |
| Local Rote| 29.5 d            | 33.0 c             | 133.5 c           | 135.67 b           |
| Gajah     | 26.2 a            | 26.5 a             | 108.3 b           | 109.33 a           |
| Jerapah   | 27.2 bc           | 28.5 b             | 107.5 a           | 108.50 a           |
| Kancil    | 26.3 a            | 26.3 a             | 108.2 ab          | 109.33 a           |
| Bison     | 27.8 c            | 28.3 b             | 108.0 ab          | 108.67 a           |
| Mean      | 27.4              | 28.5               | 113.1             | 114.3              |

Irrigation Regime

- I₀: normal/optimum condition
- I₁: stress condition

Remarks: *Average of stress and normal conditions. I₀: normal/optimum condition, I₁: stress condition. Means followed by a common letter(s) within each column do not significantly differ using DMRT at 0.05 level of significance.

Table 2. Average number of pods per plant of the tested groundnut genotypes under two irrigation regimes in two locations

| Genotype  | Number of pods per plant |
|-----------|--------------------------|
|           | I₀                   | I₁                   | Mean  | I₀       | I₁       | Mean  |
| Local Rote| 35.63 b 21.73 b 28.68 b| 20.63 d 38.40 b 39.52 c|        | 18.97 a 13.93 a 16.45 a| 14.27 a 14.53 a 17.62 ab|        |
| Gajah     | A A                  | B                    | A A    | A A      | A A      | A A    |
| Jerapah   | 17.53 a 17.63 ab 17.58 a| 17.53 ab 17.13 a 17.33 ab|        | 17.07 a 16.53 ab 16.80 a| 15.20 a 15.63 a 15.63 a|        |
| Kancil    | A A                  | A A                  | A A    | A A      | A A      | A A    |
| Bison     | 22.80 a 17.00 ab 19.90 a| 23.13 c 15.67 a 19.40 b|        | 17.13 a 17.33 A 19.40 b| 19.40 b 19.40 b 19.40 b|        |
| Mean      | 22.40 B 17.37 A 23.67 B| 20.13 A              |        |          |          |        |

Remarks: I₀: normal/optimum condition, I₁: stress condition. Means followed by a common letter(s) within each column or each row do not significantly differ using DMRT at 0.05 level of significance.

Yield Component Variables

Yield component variables observed in this study included number of pods per plant, number of seeds per pod and 100-seed dry weight. ANOVAs results showed that genotype by irrigation interaction significantly affected number of pod per plant in both locations. This implies that number of pod per plant varied according to the genotype, and the magnitude of this variation/change was determined by irrigation levels applied.

Data in Table 2 revealed that the highest number of pods per plant in Kupang was exhibited by Local Rote (35.63 pods) at optimum irrigation treatment, and was significantly higher than that of the same genotype at water stress treatment (21.73 pods). In water stress treatment, Local Rote produced the highest number of pod per plant and was significantly higher than that of Gajah but was not significantly different from other varieties. On average, Local Rote also exhibited a higher number of pods per plant (28.88 pods) compared to the tested check varieties under both irrigation treatments.

Similar with the research site in Kupang, Local Rote genotype also exhibited the highest number of pods per plant in both normal and stress conditions in Rote (Table 2). This genotype also produced the highest pod number on average for both normal and stress conditions. The better performance of Local Rote genotype in Rote Island indicates its good adaptability to the research location since this genotype was originated from this Island and has long been cultivated by the local farmers for many generations.
In contrast to the number of pods per plant, there was no significant genotype by irrigation interaction effect on the number of seeds per pod in both locations but the genotype and irrigation alone caused significant effect on the trait in Kupang. In this research location, number of seeds per pod was the highest in Kancil (1.75 seeds) but was insignificant compared to that of Gajah and Jerapah (Table 3). The average performance of all tested genotypes at normal irrigation treatment (1.74 seeds per pod) was higher than that at water stress treatment (1.57 seeds per pod) (Table 3). In Rote, the tested genotypes performed almost similarly in both normal and stress conditions.

As with number of seed per pod, 100-seed dry weight was not affected by interaction between irrigation by genotype in Kupang but the trait was significantly affected by interaction between the two treatments applied in Rote. Local Rote produced the highest mean 100-seed dry weight over two irrigation regimes in both Kupang (75.62 g) and Rote (77.45 g) which were much higher than that of other genotypes (Table 3) indicating its good adaptability to the research location. The higher 100-seed dry weight of Local Rote was also in line with the fact that this genotype possesses a larger seed size compared to other tested varieties. Under normal condition in Rote, Local Rote produced a much higher 100-seed dry weight in Rote (87.30 g), which was about 23% higher than that in water-stress condition (67.61 g) in the same location. Significant reduction of 100-seed dry weight in water stress condition was observed in most tested genotypes, except Jerapah, when the genotypes were evaluated in Rote. This implies that Jerapah was more stable for this trait than other varieties. On average, 100-seed dry weight of all genotypes provided with water stress treatment (52.91 g) was also significantly lower than that of normal irrigation (65.31 g) (Table 3).

The significant interaction effect of genotype by irrigation treatments on number of pods per plant was due to the effect of water treatment, and the magnitude of this effect varied according the different response of the tested genotypes. Optimum irrigation during plant growth and development stages ensures water availability, which is essential for soil mineral and nutrition intake by the plants. This would result in a maximum photosynthate accumulation required for optimum plant growth and development as well as plant production. Water stress condition, on the other hand, reduced soil nutrient intake by the plant that may inhibit photosynthesis process with the consequence of reduced plant growth and development. This was in line with Kambiranda et al. (2011) who maintained that water deficit affects thylakoid electron transport, phosphorylation, carboxylation and photosynthesis. Changes in the lipid content and composition are common in water-stressed plants and this increases membrane permeability, which causes damage and membrane disruption as well as reduction in photosynthesis. Furthermore, different genetic background of the tested genotypes has led to different plant responses to the water stress condition, and hence different plant products such as number of pods produced per plant, etc. In accordance with this, Winarso (2005) stated that availability of growth factors, either in an optimum or a limited/ inadequate condition during plant growth and development, determines the plant production, and whether the plant production is within a maximum or minimum levels will depend on the plant's genetic background that control its adaptation to the environment.

Results of the present study showed that Local Rote produced the highest number of pods per plant and the highest 100-seed dry weight in both optimum and water stress conditions. This implies that this local variety possesses a genetic potency that enabled it to produce higher yield component characters that were lacking in the check varieties. This result may be due to the fact that Local Rote variety has long been adapted to the local growing conditions with semi-arid climate type and low soil fertility as the predominant factors. This long process of adaptation have resulted in a local groundnut landraces such as Local Rote that has so far been a main plant-source protein for local community in this Island. The aforementioned findings comply with Fischer (1984) who stated that the capability of plant's trait expression would vary according to plant genotype and environmental condition. Local Rote variety is, therefore, said to have a genetic potency that makes it produce higher photosynthate accumulation than the check varieties. This would have led to higher production of plant products such as number of pods per plant and 100-seed dry weight, either in water stress or optimum/normal water condition.
Table 3. Average number of seeds per pod and 100-seed dry weight of the tested groundnut genotypes under two irrigation regimes in two locations

| Genotype  | Number of seeds per pod | 100-seed dry weight (g) |
|-----------|-------------------------|-------------------------|
|           | Kupang | Rote | Kupang | I₀ | I₁ | Mean |
| Lokal Rote| 1.60 a | 1.52 a | 75.62 b | 87.30 b | 67.61 b | 77.45 c |
| Gajah     | 1.67 ab | 1.67 a | 53.71 a | 61.88 a | 47.10 a | 54.49 a |
| Jerapah   | 1.67 ab | 1.68 a | 59.43 a | 62.63 a | 60.47 b | 61.55 b |
| Kancil    | 1.75 b | 1.73 a | 54.19 a | 60.05 a | 47.70 a | 53.88 a |
| Bison     | 1.58 a | 1.58 a | 52.61 a | 55.83 a | 48.77 a | 52.30 a |
| Mean      |        |        | 65.54 B | 54.33 A |

Irrigation

|          | I₀ | I₁ | Mean |
|----------|----|----|------|
| Kupang   | 1.74 b | 1.65 a | 65.31 b |
| Rote     | 1.57 a | 1.63 a | 52.91 a |

Remarks: I₀: normal/optimum condition, I₁: stress condition. Means followed by a common letter (s) within each column or each row do not significantly differ using DMRT at 0.05 level of significance.

Seed Yield and Level of Tolerance to Drought

Variance analysis revealed significant effect of irrigation by genotypes interaction on seed yields of tested groundnut genotypes both in Kupang and in Rote. As with irrigation by genotype interaction effect, either the main plot treatment (irrigation) or sub-plot treatment (genotype) alone also exhibited significant effect on seed yields. Average seed yields of the genotypes under normal (Yp) and stress (Ys) conditions in both locations are presented in Table 4. In Kupang, an average seed yield per plot of the tested genotypes was 0.88 kg plot⁻¹ in normal condition and 0.64 kg plot⁻¹ in stress condition while in Rote, the average seed yield was 0.92 kg plot⁻¹ in normal condition and 0.65 kg plot⁻¹ in water stress condition (Table 4). On average, seed yields decline was about 34% (39.7% in Kupang and 27% in Rote) in water stress condition compared to optimum condition. This decline was close to that observed by Ekanayake et al. (1990) indicating moderate drought stress index (0.3) of the trial condition. Observed yields of the four check varieties were below their yield potentials. Groundnut yield decline due to drought stress was also reported by other workers (Reddy et al., 2003; Songsri et al., 2008; Songsri et al., 2009).

In normal irrigation treatment, seed yield of Local Rote genotype was much higher than that of the four check varieties. The same situation holds for water stress treatment (Table 4). The mean seed yields of Local Rote at both conditions at the two research sites were also higher than the check varieties. Higher seed yield of Local Rote was supported by higher yield component such as the number of pods per plant (Table 2) and 100-seed weight (Table 3), which implies that this genotype was superior over the check varieties in both yield performance as well as adaptation capacity to stress condition in the trial locations.

Drought tolerance levels of the tested genotypes were assessed based on four selection indices, i.e. stress tolerance index (STI), stress susceptibility index (SSI), percent yield loss (YL), and geometric mean productivity (GMP). Research results revealed that STI values of the genotypes ranged from 0.34 to 1.76 in Kupang and 0.32 to 1.92 in Rote (Table 3). Only the local genotype, i.e. Local Rote was considered tolerant to drought based on its high STI value (≥1.0) while the four check varieties were considered susceptible to drought stress based on their low STI values (≤1.0). Genotypes with high STI values were considered drought tolerant while those with lower STI values were considered drought susceptible (Fischer and Maurer, 1978). The local genotype considered tolerant based on STI was also considered tolerant based on geometric mean productivity, GMP (Table 4).
Table 4. Average seed yields of groundnut genotypes under optimal (Yp) and stress (Ys) conditions, and calculated drought tolerance indices at two locations

| Genotype    | Location: Kupang | Location: Rote |
|-------------|------------------|----------------|
|             | Seed yield (kg.plot⁻¹) | Drought Tolerance Indices |              |                      |                      |
|             | Yp*              | Ys              | MP   | GMP | STI | SSI | YL |
| Local Rote  | 1.49 c           | 0.92 d          | 1.21 c | 1.17 | 1.76 | 0.31 | 38.26 |
| Gajah       | 0.74 b           | 0.35 a          | 0.54 a | 0.51 | 0.34 | 0.43 | 52.70 |
| Jerapah     | 0.82 b           | 0.66 c          | 0.74 b | 0.74 | 0.70 | 0.16 | 19.51 |
| Kancil      | 0.81 b           | 0.76 c          | 0.79 b | 0.78 | 0.79 | 0.05 | 6.17  |
| Bison       | 0.55 a           | 0.52 b          | 0.54 a | 0.53 | 0.37 | 0.04 | 5.45  |
| Mean        | 0.88             | 0.64            | 0.76   | 0.75 | 0.79 | 0.20 | 24.42 |
| Local Rote  | 1.60 c           | 0.53 d          | 1.31 c | 1.28 | 1.92 | 0.28 | 35.93 |
| Gajah       | 0.75 b           | 0.36 a          | 0.55 a | 0.52 | 0.32 | 0.40 | 51.62 |
| Jerapah     | 0.86 b           | 0.60 b          | 0.73 b | 0.72 | 0.60 | 0.24 | 30.52 |
| Kancil      | 0.84 b           | 0.79 c          | 0.81 b | 0.81 | 0.77 | 0.05 | 6.22  |
| Bison       | 0.57 a           | 0.48 ab         | 0.52 a | 0.52 | 0.32 | 0.13 | 17.03 |
| Mean        | 0.92             | 0.65            | 0.79   | 0.77 | 0.70 | 0.22 | 28.26 |

Remarks: *Yp(normal/optimal condition), Ys(stress condition), MP (mean productivity), GMP (geometric mean productivity), STI (stress tolerance index), SSI (stress susceptibility index), YL (percent yield loss)

This finding is supported by highly significant correlations observed between the two selection indices (Table 5). It is interesting to note that the genotype selected based on STI and GMP (Table 5) was also the best yielding genotype in both normal and stress conditions (Table 4). This implies that STI and GMP are reliable selection indices to select for drought tolerant and high yielding genotypes in both normal and stress conditions. The results of this study were closely in line with previous works (Sio-Se et al., 2006; Golbashy et al., 2010).

Stress susceptibility index (SSI) of the tested genotypes ranged from 0.04-0.43 in Kupang and 0.05-0.40 in Rote (Table 4). Selection based on SSI favored all tested genotypes due to their low SSI values (<0.5) (Table 4 and Table 5). A high SSI value indicates high susceptibility to drought while a low SSI value indicates tolerance to drought (Fischer and Maurer, 1978). Of the five tested genotypes selected on the basis of SSI, only four genotypes, i.e. Bison, Kancil, Jerapah, Local Rote were also considered tolerant on the basis of percent yield loss (YL) (Table 5) due to their lower percentage of yield loss (<50%) (Table 4). Genotypes with low SSI values and low percentage of yield reduction (YL) in stress condition were identified as tolerant genotypes; however, these genotypes were, in general, low yielding in both normal and stress conditions, except the local variety, Local Rote that yielded best in both irrigation conditions either in Kupang or in Rote Ndao (Table 4). This implies that SSI and YL were reliable indices to be selected for drought tolerant genotypes but partly determinative in selecting the best yielding genotypes in both normal and stress conditions. Similar results were reported by other workers (Bahar and Yildirim, 2010; Golbashy et al., 2010; Sanjari et al., 2010; Mau, 2011).
Table 6. Correlations between selection indices and mean yield of groundnut genotypes under normal and stress conditions at two locations

| Location: Kupang | Yp     | MP     | GMP    | STI    | SSI    | YL     |
|------------------|--------|--------|--------|--------|--------|--------|
| Yp               | 0.77** | 0.96** | 0.95** | 0.97** | 0.42   | 0.42   |
| Ys               | 0.91** | 0.93** | 0.89** | -0.24^ns| -0.24^ns|        |
| MP               | 1.00** | 1.00** | 0.16^ns|        |        |        |
| GMP              | 0.99** | 0.11^ns|        |        |        |        |
| STI              | 0.19^ns|        |        |        |        |        |
| SSI              |        |        |        |        |        |        |

| Location: Rote   | Yp     | MP     | GMP    | STI    | SSI    | YL     |
|------------------|--------|--------|--------|--------|--------|--------|
| Yp               | 0.86   | 0.9^*  | 0.97   | 0.98   | 0.24^ns| 0.24^ns|
| Ys               | 0.95   | 0.96   | 0.93   | -0.27^ns| -0.27^ns|        |
| MP               | 1.00   | 1.00   | 0.04^ns|        |        |        |
| GMP              | 0.99   | -0.01^ns|        |        |        |        |
| STI              | 0.06^ns|        |        |        |        |        |
| SSI              |        |        |        |        |        | 1.00^ns|

Remarks: ** Significant at P≤0.01 level, * Significant at P≤0.05 level, ns: not significant

Positive and significant correlation between Yp and Ys with STI and GMP (Table 6) indicates that STI and GMP can be used to select for drought tolerant and high yielding genotypes in normal and stress conditions. On the contrary; negative and insignificant correlation between Ys with either SSI or YL implies that SSI and YL were able to detect drought tolerant genotypes but partly effective in selecting high yielding genotypes in stress condition.

Overall, the results of the present study revealed only one tolerant groundnut genotype, i.e, Local Rote, on the basis of four selection indices, i.e. STI, SSI, YL and GMP. This local variety was not only drought tolerant but also high yielding in both normal and stress conditions.

CONCLUSION

The present study demonstrated significant effect of drought stress on groundnut genotype’s seed yields. Local Rote genotype was found to be the best performing genotype under normal and stress conditions in both Kupang and Rote research locations. Mean seed yield per plot of this genotype over two irrigation treatments in Kupang was 1.21 kg.plot\(^{-1}\) (2.02 t.ha\(^{-1}\)) and that in Rote Island was 1.31 kg.plot\(^{-1}\) (2.18 t.ha\(^{-1}\)). On average, seed yield over two locations was 1.26 t.ha\(^{-1}\). Although the four check varieties were considered drought tolerant based on SSI and YL values, these varieties; however, performed poorly under the trial conditions as indicated by their lower yields compared to their yield potentials. Local Rote genotype was, therefore, considered and selected as the drought tolerant and high yielding variety in both normal and stress condition based on STI and GMP. These two selection indices were reliable to be employed in selection of drought tolerant and high yielding groundnut genotypes in future works.

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