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# Evaluation of Genotype –Enviroment Interactions of New Peanut Varieties Conditions of Tra Vinh

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***Abstract***— *The experiment comprised of 10 lines were laid out in a randomized block design replicated three times at 6 different locations at Dong Xuan and HeThu season from Tra Vinh . Analysis of variance indicated the presence of significant genetic variability among the genotypes for peanut under all the 6 location. All analyses of variance for the yield of peanut that were pooled over the six locations . Genotypes x Enviroment ( GxE) interactions were also found significant and the mean squares due to environment were highly significant indicating sufficient diversity among the environments. Four lines HATRI 02DP, HATRI 03DP, HATRI 14DP give hight yield both dong xuan and wet season . performed better by in all the locations both satbility at Dong Xuan and HeThu seasones. This varieties is good for multilication in the future .*

***Keywords***— ***AMMI. Genotypes x Enviroment (GxE) interactions, Peanuts, adaptability, stability***

## I. INTRODUCTION

Genotype(s) for the test settings in a part of the Southwest region of Nigeria, as well as to investigate the nature and extent of genotype × environment interaction (GEI) effects on Bambara groundnut (BGN) production.The results revealed that BGN accessions performed differently in different test conditions, indicating that the interaction was crossover in nature. To examine and show the pattern of the interaction components, biplots with the genotype main effect and genotype × environment interaction (GEI) were used. (**Oluwaseyi** et la.,2021).Its yield stability and adaptability determine any crop variety's ability to thrive in a given environment. Due to differences in the various environments, these traits are influenced by genotype × environment interactions (GEI). Plant breeders are increasingly interested in GEI to identify long-term solutions to issues controlling plant growth and development. Because of the increasing interest, several statistical methods have been developed for multi-environment trials (MET) to study GEI effects(Eberhart et al.,1966 ; Crossa et al.,1990). The two most common methods used for MET are additive main effects and multiplicative interaction (AMMI), and genotype plus genotype environment interaction (GGE) biplot (Alizadehet al.,2017). The findings derived from the AMMI 2 analysis have yielded support for the significance of including IPCA2 scores in conjunction with IPCA1 scores to enhance our understanding of genotype-environment interactions (GEI) across diverse settings. Moreover, the utilisation of this methodology has facilitated the identification of genotypic adaptations, as depicted(Praveen et al.,2024). Different abiotic stresses often occur together or one after another in the same crop season. Some of the common abiotic stresses that limit rice crop growth and productivity are drought, salinity, nutrient deficiency and high temperature. Of these, drought and phosphorus deficiency have become major concerns which affect rice production. especially in water limited cultivation systems. (Yugandhar et al.. 2018). The environment, the genotype and the GE interaction are also responsible for variations in the quality properties of grains, including the color, the texture, the protein and the fiber content. Among the quality parameters, the protein content of the grains is highly affected by the environment (Nehe et al.,2019). The evaluation of different genotypes on quality traits associating with the improvement of the yield can also contribute to future breeding strategies. In AMMI, the additive portion is analyzed through Analysis of Variance (ANOVA) and interaction effects through the Principal Component Analysis (PCA) model. Biplots helps in displaying genotypic stability statistics and clustering of genotypes based on their performance in different environments

(Thillainathan et al 2001). GGE biplot gives more detailed graphical representation of mean values and stability and displays the which-won-where pattern of genotypes. It also identifies mega environments for selection and discriminating test environments (Sanchez et al 2017). The biplot and the GGE concepts are used in the GGE biplot method to visually analyze the results of site regression analysis in MET data ( Yan et al.2003). The concept of GGE biplot involves the use of biplot to show the two important factors, which are also sources of variation (viz., G and GE). GGE biplot fits best for genotype evaluation (mean vs. stability), test environments which provide discriminating power vs. representativeness, and multi-environment analysis (Angelini et la.,2019). GGE biplot is a versatile method with the ability to analyze a range of data types using a two-way structure (Fayeun et al.2018). Since the introduction of the GGE biplot, numerous applications of the method on MET analysis have been reported.This study's main objectives were to characterise peanut genotypes at six locations in terms of yield-related traits, and assess genotype-by-environment interaction and identify stable genotypes yield-related traits in six lines peanut growing regions of Tra Vinh.

## II. MATERIALS AND RESEARCH METHODS

### 2.1 Peanut varieties

Use varieties: Peanuts HATRI 02 DP, HATRI 03 DP, HATRI 14 DP, VD 08. VD 01-1, MD7 (as control varieties)

### 2.2 Research method

The experiment was arranged in a completely randomized design (CRD) with 6 treatments (treatments = 6), in which each treatment was arranged to plant 1 variety and 3 replications (replications = 3). Thus, there were a total of: 6 x 3 = 18 experimental plots (plots = 18). Each plot (corresponding to 1 replication) had an area of 250m2 planted with 1 peanut variety in 06 varieties: HATRI 02 DP, HATRI 03 DP, HATRI 14 DP, VD08, VD01-1, MD7 (control) and was arranged in 01 district in 03 districts of Cau Ngang, Tra Cu, Duyen Hai to control between treatments. In which:

- Experiment I: Planting peanuts: HATRI 02 DP;
- Experiment II: Planting peanuts of HATRI 03 DP;
- Experiment III: Planting peanuts of HATRI 14 DP;
- Experiment IV: Planting peanuts of VD08;
- Experiment V: Planting peanuts of VD01-1;
- Experiment VI: Planting additional MD7 variety as a control variety.

In each district, all 6 experiments were carried out at 1 household in locations that were relatively homogeneous in terms of terrain, soil, light, etc.

Thus, the total area implemented on 3 experimental sites is: 0.075ha x 6 experimental plots x 3 districts (sites) x 2 crops = 2.7ha

### 2.3 Monitoring indicators

- Periodically collect agronomic, pest and yield indicators.

+ Agronomic indicators: tree height, number of primary branches, flowering time, harvest time, dry matter accumulation capacity, yield components and yield components. Collect every 15 days.

+ Pest and disease indicators:

Record and evaluate the possibility of pest and disease attack by the 5-point cross-root method, each point monitors and observes 10 plants. Record at 3 periods of plant development:

Period 1: 20-40 days after sowing.

Period 2: 60-70 days after sowing.

Period 3: before harvest.

The disease level is assessed on a 9-level scale.

The rate of diseased plants is assessed in %.

+ Yield index:

Using the 5-point diagonal distribution method to collect the factors that contribute to the yield recorded with: number of fruits/tree, number of firm fruits/tree, weight of 100 fruits, weight of 100 seeds. Data recorded on 20 surveyed trees at each collection point.

Record the number of seeds/fruit, number of firm seeds/fruit, length and width of fruit, and the ratio of 3-seed fruits. Each repetition was 10 trees, 3 repetitions.

+ Statistical method for data processing: data were collected and processed using Excel software and statistical processing software MSTATC or SPSS.

Report on the evaluation of the adaptation, growth and development, yield, output and economic efficiency indicators of the experiments:

- Analyze and compare data on agronomy, pests and yields collected directly to develop a report on the adaptability, growth and development of new peanut varieties in the experiments.

- Directly interview farmers using a prepared questionnaire on production investment costs (labor, fertilizer, chemicals, transportation, others) and peanut production results (number of crops, classification, selling price and profit). The collected data will be compiled, analyzed, compared, and evaluated to assess the economic efficiency of experiments on new peanut varieties including total investment costs, total income, net profit, and return on investment capital..

➢ **Evaluate stability and adaptability using the model according to Eberhart and Russell (1966):**

Yij = □i + biIj + □ij

Yij: expression of genotype i (ith) in environment j

(jth)

i: average of all genotypes across all environments

bi: regression coefficient of genotype ith on environmental index

ij: deviation from regression of genotype ith in environment jth

Ij: environmental index

The yield of varieties can be predicted by the regression equation:

Y = Xi + biIj + S2di

Xi: average yield of varieties across environments

bi: regression coefficient is calculated by the formula bi = (Yij Ij)/ I2j

Ij = Yij/V - Yij/VL

where: V – Number of varieties

L – Number of experimental points

S2di = [ 2ij/(L – 2)] - S2e/r

where: 2ij = [ Y2ij - Y2i./L] – [ Yij I2j]2/ I2j

s2e: average variance of genotype on all environments

r: number of repetitions of a genotype on an environment

According to the above model, genotypes with S2di = 0 are considered stable, adapted to the environment, genotypes with S2di 0 are unstable, not adapted to the environment.

If S2di ≠ 0: the relationship between phenotype and environment (Ij) does not follow a linear regression line (linear), the variety is unstable.

Analyze stability and adaptation according to the model according to Eberhart and Russell (1966) using stability software version 3.0 by Nguyen Dinh Hien (Agricultural University 1).

- Data were analyzed by point, across multiple points using analysis of variance (ANOVA) using MSTAT.C, SAS 9.1 software, ranking treatments by LSD test at = 0.05..

**Additive Main Effects and Multiplicative Interaction Model**

The classical genotype-environment interaction method has focused on the stability event more than the adaptation event. Therefore, AMMI analysis is synthesized on the basis of the models of Finley and Wilkinson (1963), Eberhart and Russel (1966), Perkins and Jinks (1968), Freeman and Perkin (1971) and many other authors, including many IRRI scientists. Illustration of AMMI diagram of gene-environment interaction using IRRISTAT software.

- Illustration of the diagram of grouping hybrid lines using UPGMA Euclidean coefficient on SAS 9.1

- Samples after harvest will be collected and evaluated for indicators according to ICRISSAT standards.

## III. RESEARCH RESULTS AND DISCUSSION

### 3.1 Evaluation of genotype-environment interactions in the 2023 Winter-Spring crop

The results of peanut yield evaluation at 6 locations: Cau Ngang, Tra Cu, Duyen Hai, Can Tho, Long An, and An Giang of the peanut variety/line are presented in Table 4.14. The results of the yield changes show that: the F test is statistically significant at the 1% level for the linear hypothesis of environment, variety, and variety interaction with environment.

The yield of the 2023 Winter-Spring crop was observed on 10 varieties with 6 different environments, the highest yield was the HATRI 14 DP variety (5.75 tons), followed by the HATRI 16 DP variety (5.70), HATRI 15 DP (5.54) and HATRI 20 DP variety reaching 5.49 tons/ha on average across 6 locations.

This allows us to use the environmental index (Ij) to represent each location, on the interaction diagram between genotype and environment with the order from less favorable to more favorable as follows: Duyen Hai is the highest > Tra Cu > Cau Ngang, Can Tho is on the Ij axis with values in order: 0.103; 0.113; 0.022; 0.017; - 0.38, 0.54 in order. When grouping the environment, Duyen Hai scores the highest.

| Environment | Medium | SE | DUNCAN | GROUPS | LSD | TESTS |
|---|---|---|---|---|---|---|
| Duyen Hai | 7.1450 | 0.12134 | . | | | |
| Tra Cu | 6.9033 | 0.99073E-01 | .. | | | |
| Cau Ngang | 6.7833 | 0.99073E-01 | 1.. | | | |
| An Giang | 4.0900 | 0.99073E-01 | 333. | | | |
| Can Tho | 3.9033 | 0.99073E-01 | 333.. | | | |
| Long An | 3.3250 | 0.85799E-01 | 33333. | | | |

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When grouping by genotype, the most common variety is HATRI 14 DP, followed by HATRI 16 DP, HATRI 15 DP.

| varieties | Madium | SE | DUNCAN | GROUPS | LSD | TESTS |
|---|---|---|---|---|---|---|

HATRI 14 ĐP 5.7456 0.12817 ...
HATRI 16 ĐP 5.7067 0.12817 ..
HATRI 15 ĐP 5.5400 0.12817 ...
HATRI 20 ĐP 5.4956 0.12817 ...
HATR I6 ĐP 5.4511 0.12817 ....
HATRI 13 ĐP 5.2567 0.12817 21.....
HATRI 03 ĐP 5.2400 0.12817 21.....
HATRI 02 ĐP 5.2233 0.12817 21.....
HATRI 01 ĐP 5.0011 0.12817 33221....
MD7 4.9233 0.12817 33222.....

*Table 1: Yield (tons/ha) of peanut varieties/lines tested at 6 locations in the 2023 Winter-Spring crop*

| Varieties | Can Tho | Tra Cu | Duyen Hai | Cau Ngang | Long An | An Giang | Mean |
|---|---|---|---|---|---|---|---|
| HATRI 01 ĐP | 3.56 | 6.20 | 7.15 | 6.40 | 3.30 | 3.40 | 5.00 |
| HATRI 02 ĐP | 3.63 | 7.13 | 6.90 | 6.07 | 3.52 | 3.93 | 5.22 |
| HATRI 03 ĐP | 3.63 | 7.10 | 6.50 | 6.53 | 4.47 | 3.90 | 5.24 |
| HATRI 06 ĐP | 4.06 | 6.70 | 7.60 | 7.06 | 3.25 | 4.20 | 5.45 |
| HATRI 13 ĐP | 3.80 | 6.76 | 7.45 | 6.90 | 3.37 | 3.33 | 5.25 |
| HATRI 14 ĐP | 4.23 | 6.80 | 7.30 | 7.30 | 3.60 | 5.56 | 5.74 |
| HATRI 15 ĐP | 4.20 | 7.26 | 7.15 | 7.260 | 3.31 | 4.13 | 5.54 |
| HATRI 16 ĐP | 4.36 | 7.53 | 7.35 | 6.76 | 3.31 | 4.50 | 5.70 |
| HATRI 20 ĐP | 3.53 | 7.16 | 7.20 | 6.83 | 2.55 | 4.60 | 5.50 |
| MD7 | 3.90 | 6.90 | 6.85 | 6.76 | 3.33 | 3.61 | 4.71 |
| **Mean** | **3.90** | **6.91** | **7.15** | **6.70** | **3.33** | **4.10** | **5.14** |
| **IJ** | **0.103** | **0.113** | **0.022** | **0.017** | **- 0.38** | **0.54** | |

Most of the hybrid lines had higher average yield than the control variety MD7 (4.71 tons/ha). The difference in yield between the varieties was significant at the 5% level based on the yield assessment scale through multiple point analysis. The highest yield points were Duyen Hai (7.15 tons/ha), Tra Cu (6.91 tons/ha), followed by Cau Ngang (6.70 tons/ha). ANOVA analysis for the yield of peanut varieties across 6 environments showed that the difference in yield between the varieties was statistically significant at the 1% level, but the stability of yield, as well as the adaptability, was very different, through a very significant GxE (linear) interaction. The results of ANOVA analysis allowed us to consider the interaction between variety and environment here as linear...

**3.2 Evaluation of genotype-environment interaction in the 2023 Summer-Autumn crop**

The results of yield evaluation across 6 locations (Cau Ngang, Tra Cu, Duyen Hai, Can Tho, An Giang, Long An) of the peanut variety/line recorded yield developments showing: the F test was statistically significant at the 1% level for the linear hypothesis of environment, variety, and variety interaction with environment.

The 2023 Summer-Autumn crop yield was observed on 10 varieties with 6 different environments, the highest average yield was the HATRI 16 DP variety (4.99 tons/ha), followed by the HATRI 15 DP variety (4.88 tons/ha), HATRI 14 DP (4.88 tons/ha) and HATRI 20 DP reached 4.84 tons/ha.

This allows us to use the environmental index (Ij) to represent each location, on the interaction diagram between genotype and environment with the order from less favorable to more favorable as follows: Duyen Hai is highest > Tra Cu > Cau Ngang. Can Tho, Tra Cu, Cau Ngang and Duyen Hai, Long An and An Giang are on the Ij axis with values in order: 0.113; 0.189; 0.015; 0.016; -0.33, -0.45 in order.

When grouping the environment, Duyen Hai has the highest score

| Environment | Medium | SE | DUNCAN GROUPS | LSD TESTS |
|---|---|---|---|---|
| Duyen Hai | 6.5800 | 0.87659E-01 | . | |
| Tra Cu | 6.1967 | 0.71573E-01 | 2. | |
| Cau Ngang | 6.1933 | 0.71573E-01 | 2.. | |
| An Giang | 3.3833 | 0.71573E-01 | 333. | |
| Can Thơ | 3.2833 | 0.71573E-01 | 333.. | |
| Long An | 2.8275 | 0.61984E-01 | 33333. | |

Genotypic grouping

| | SE | DUNCAN GROUPS | LSD TESTS |
|---|---|---|---|
| HATRI 16 ĐP | 4.9974 | 0.92593E-01 | . |
| HATRI 15 ĐP | 4.8863 | 0.92593E-01 | .. |
| HATRI 14 ĐP | 4.8807 | 0.92593E-01 | ... |
| HATRI 20 ĐP | 4.8474 | 0.92593E-01 | .... |
| HATRI 06 ĐP | 4.7529 | 0.92593E-01 | ..... |
| HATRI 02 ĐP | 4.7196 | 0.92593E-01 | 1..... |
| HATRI 03 ĐP | 4.6751 | 0.92593E-01 | 1..... |
| HATRI 01 ĐP | 4.6363 | 0.92593E-01 | 2..... |
| HATRI 13 ĐP | 4.5418 | 0.92593E-01 | 2111..... |
| MD7 | 4.5029 | 0.92593E-01 | 3221..... |

*Table 2: Yield (tons/ha) of peanut varieties/lines tested at 6 locations in the Summer-Autumn crop 2023*

| varieties | Can Tho | Tra Cu | Duyen Hai | Cau Ngang | Long An | An Giang | mean |
|---|---|---|---|---|---|---|---|
| HATRI 01 ĐP | 3.0 | 5.63 | 6.80 | 5.93 | 2.80 | 3.73 | 4.63 |
| HATRI 02 ĐP | 3.10 | 6.23 | 6.40 | 6.28 | 2.90 | 3.40 | 4.71 |
| HATRI 03 ĐP | 3.0 | 6.33 | 6.75 | 6.08 | 2.98 | 2.93 | 4.67 |
| HATRI 06 ĐP | 3.27 | 6.23 | 6.70 | 6.33 | 2.80 | 3.23 | 4.75 |
| HATRI 13 ĐP | 3.10 | 6.30 | 6.50 | 5.83 | 2.68 | 2.90 | 4.54 |
| HATRI 14 ĐP | 3.33 | 6.20 | 6.70 | 6.30 | 2.78 | 4.03 | 4.88 |
| HATRI 15 ĐP | 3.73 | 6.30 | 6.65 | 6.38 | 2.83 | 3.47 | 4.88 |
| HATRI 16 ĐP | 3.50 | 6.50 | 6.85 | 6.16 | 3.35 | 3.53 | 4.99 |
| HATRI 20 ĐP | 3.60 | 6.30 | 6.40 | 6.50 | 2.73 | 3.53 | 4.84 |
| MD7 | 3.30 | 5.93 | 6.05 | 6.18 | 2.45 | 3.07 | 4.50 |
| **Medium** | **3.28** | **6.23** | **6.58** | **6.20** | **2.83** | **3.38** | **4.54** |
| **IJ** | **0.113** | **0.189** | **0.015** | **0.016** | **- 0.33** | **-0.45** | |

Regarder peanut varieties, most hybrid lines have higher average yield than the control variety MD7 (4.50 tons/ha). The difference in yield of the varieties is very significant at the 5% level based on the yield assessment scale through multi-point analysis. The highest yield points are Duyen Hai (6.58 tons/ha), Tra Cu (6.23 tons/ha), followed by Cau Ngang (6.20 tons/ha). ANOVA analysis of yield of 10 bean varieties through 6 environments shows that the difference in yield of the varieties is statistically significant at the 1% level, but the stability of yield, as well as the ability to adapt, is very different, through the very significant GxE (linear) interaction. The results of ANOVA analysis allow to consider the interaction between variety and environment here as linear..

### 3.3 Assessment of stability and adaptation using the model of Eberhart and Russell (1966)

**Assessment of stability and adaptability in the 2023 Winter-Spring crop**

Through the analysis of the table, we can see the slope corresponding to the yield adaptation index of the varieties in different ecological zones, showing that the variety with

a good adaptation slope is the HATRI 20 DP variety with a slope coefficient = 1, followed by the HATRI 20 DP variety. The interactive contribution of the varieties on the stability index shows that the HATRI 20 DP variety has an environmental interaction index of 0, followed by the HATRI 06 DP and HATRI 16 DP varieties, HATRI 15 DP varieties. It proves to be very stable when analyzing the conditions in this crop. If compared with MD7, it also shows high stability suitable for the ecological zone. There are three varieties with very strong environmental impact conditions, the HATRI 16 DP variety followed by the HATRI 15 DP variety.

*Table 3: Analysis of stability index and adaptation to different environments in the 2023 Winter-Spring crop*

| varieties | Productivity | Stability Index | Adaptability index |
|---|---|---|---|
| HATRI 01 ĐP | 5.00 | 0.09 | 1.0689 |
| HATRI 02 ĐP | 5.22 | 0.13 | 0.8383 |
| HATRI 03 ĐP | 5.24 | 0.08 | 1.1024 |
| HATRI 06 ĐP | 5.45 | 0.05 | 0.9665 |
| HATRI 13 ĐP | 5.26 | 0.12 | 0.9947 |
| HATRI 14 ĐP | 5.75 | 0.18 | 0.6352 |
| HATRI 15 ĐP | 5.54 | 0.05 | 0.9665 |
| HATRI 16 ĐP | 5.71 | 0.05 | 0.9665 |
| HATRI 20 ĐP | 5.50 | 0.04 | 1.0462 |
| MD7 | 4.92 | 0.07 | 1.0194 |

❖ **Assessment of stability and adaptability in the Summer-Fall crop 2023**

To study peanut lines of different origins and compare with varieties in the past 3 years, peanut varieties were tested and improved in yield as well as peanut quality for Tra Vinh province.

The widely selected lines were evaluated on 10 peanut varieties that were widely deployed with an average yield of 6 points.

The test was conducted on 6 points and 10 varieties with high yield, over 6 points in Tra Vinh districts (Cau Ngang, Tra Cu, Duyen Hai). 3 more provinces were added for comparison: Can Tho; An Giang and Long An.

If considering the adaptation index (bi) and stability index (Sdi2), it shows that most of the varieties with the highest bi and stability index are HATRI 06 DP, HATRI 13 DP, HATRI 15 DP, followed by HATRI 16 DP, HATRI 20 DP, MD7. Most of the varieties have high adaptation index.

*Table 4: Analysis of stability index and adaptation to different environments in the Summer-Autumn crop 2023*

| varieties | Productivity | Stability Index | Adaptability index |
|---|---|---|---|
| HATRI 01 ĐP | 4.64 | 0.31 | 1.041441 |
| HATRI 02 ĐP | 4.72 | 0.02 | 1.001742 |
| HATRI 03 ĐP | 4.68 | 0.07 | 1.089535 |
| HATRI 06 ĐP | 4.75 | 0.01 | 1.000035 |
| HATRI 13 ĐP | 4.54 | 0.02 | 1.000098 |
| HATRI 14 ĐP | 4.88 | 0.07 | 1.089535 |
| HATRI 15 ĐP | 4.89 | 0.03 | 1.000078 |
| HATRI 16 ĐP | 5.00 | 0.04 | 1.000356 |
| HATRI 20 ĐP | 4.85 | 0.04 | 1.000356 |
| MD7 | 4.50 | 0.04 | 1.000356 |

### 3.4. Additive Main Effects and Multiplicative Interaction Model

The classical genotype-environment interaction method has focused on the stability event more than the adaptation event. Therefore, AMMI analysis is synthesized on the basis of the models of Finley and Wilkinson (1963), Eberhart and Russel (1966), Perkins and Jinks (1968), Freeman and Perkin (1971) and many other authors, including many IRRI scientists. Illustration of AMMI diagram of gene-environment interaction using IRRISTAT software.

- Illustration of the diagram of grouping hybrid lines using UPGMA Euclidean coefficient on SAS 9.1

- Samples after harvest will be collected and evaluated for indicators according to ICRISSAT standards.

❖ **Results recorded in the 2023 Winter-Spring crop**

Correlation shows that the contribution value of multidimensional interaction according to AMMI analysis is very significant. The genotype x phenotype interaction reached 89.7%.

ANOVA analysis of AMMI shows that all three AMMI 1, AMMI 2, AMMI 3 are significant at the 0.01 level, except AMMI 4. This shows that the points are very favorable in the study.

Through the analysis of the AMMI diagram, the interaction level of yield on 6 points reached 77.7%, which is very high. The diagram analysis shows that the HATRI 06 DP variety is very stable, followed by the HATRI 14 DP variety. The variety that is sensitive to the environment is the variety but because it has a negative interaction with the environment, the varieties such as HATRI 03 DP, HATRI 13 DP, HATRI 20 DP have a positive interaction with the environment. Based on the AMMI diagram, the varieties HATRI 02 DP, HATRI 03 DP and HATRI 16 DP are suitable for Tra Cu and the varieties HATRI 15 DP and HATRI 20 DP are suitable for Cau Ngang area, the varieties HATRI 01 DP, HATRI 06 DP, HATRI 15 DP are suitable for Duyen Hai area.

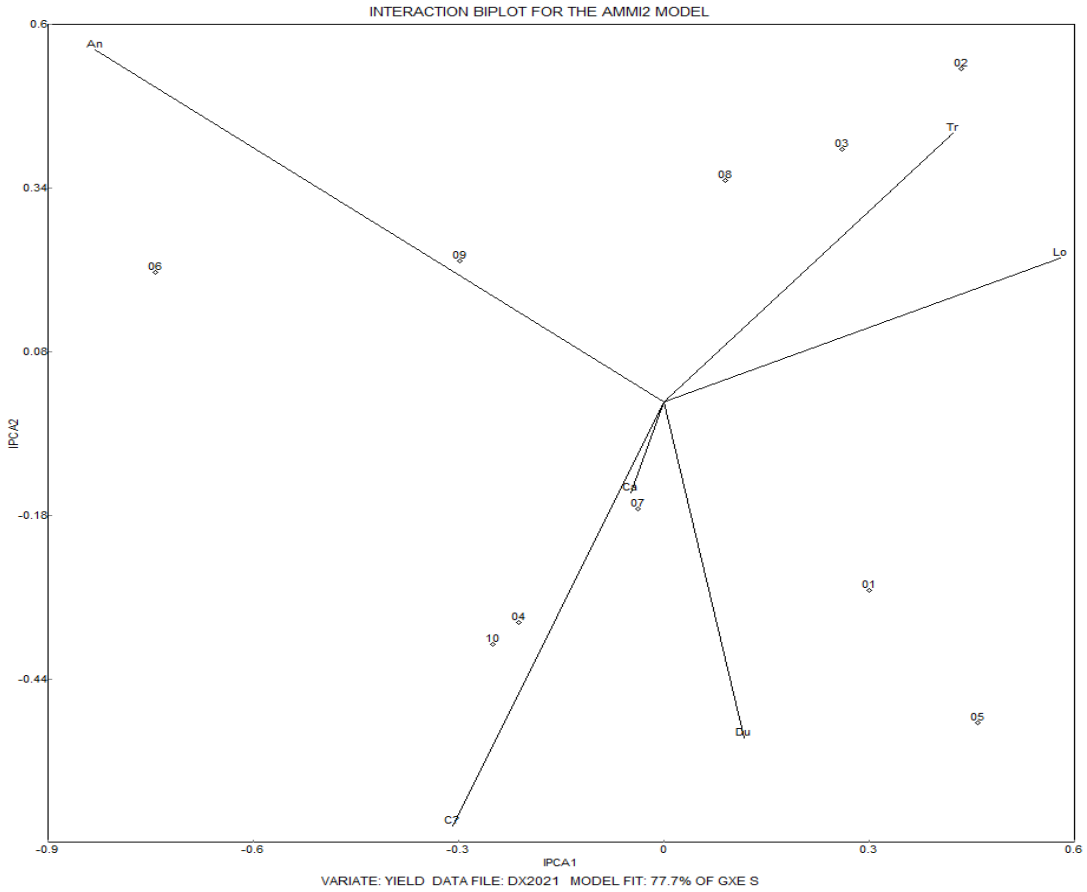


*Fig.1: Yield interaction level on 6 location in Winter-Spring crop 2023*

The observation in Figure 1 shows that the HATRI 16 DP and HATRI 20 DP varieties tend to lie on the axis with the environment and have a positive interaction, which is also consistent with the analysis in 2023.

***Variance analysis of AMMI model in Winter-Spring crop 2023***

ANALYSIS OF VARIANCE FOR THE AMMI MODEL

| SOURCE | D.F. | S.S. | M.S. | F | FPROB |
|---|---|---|---|---|---|
| TREATMENTS | 9 | 4.14669 | 0.460743 | | |
| LOCATIONS | 5 | 155.138 | 31.0277 | | |
| TREATMENT X SITES | 45 | 4.41693 | 0.981539E-01 | | |
| AMMI COMPONENT 1 | 13 | 1.72774 | 0.132903 | 1.581 | 0.143 |
| AMMI COMPONENT 2 | 11 | 1.70369 | 0.154881 | 3.300 | 0.009 |
| AMMI COMPONENT 3 | 9 | 0.705942 | 0.784381E-01 | 3.367 | 0.027 |
| AMMI COMPONENT 4 | 7 | 0.240924 | 0.344177E-01 | 4.456 | 0.061 |
| GXE RESIDUAL | 5 | 0.386199E-01 | | | |
| TOTAL | 59 | 163.702 | | | |

The differences in yield between the varieties are significant at the 0.01 level. The stability level is similar, but the adaptability is very different, through a highly significant GxE (linear) interaction. The results of the ANOVA analysis allow us to consider the interaction between variety and environment here as linear. Surprisingly, many analysis points show that the environmental index tends to 0.

Genetic grouping based on the yield of peanut lines as well as the cultivation locations was carried out in this season to classify the genotypes and the environment corresponding to each genotype that brings the best cultivation efficiency. The results of the genetic grouping are expressed in terms of genotype at a difference level of about 30%, the lines/varieties are divided into 4 main groups: Group I includes 3 lines: HATRI 20 DP, HATRI 06 DP, HATRI 14 DP (high yield group); Group II has 2 lines: HATRI 15 DP, HATRI 16 DP; Group III has 1 line: HATRI 03 DP; Group IV includes 3 remaining lines/varieties: HATRI 01 DP, HATRI 02 DP, HATRI 13 DP (low yield group). Regarding the cultivation environment, at a difference of about 50%, there are four different environmental groups. Group I includes 2 locations (Long An, Tra Cu). Group II has 1 location: Duyen Hai. Group III has 1 location: Cau Ngang, Group IV includes 2 locations: Can Tho and An Giang.

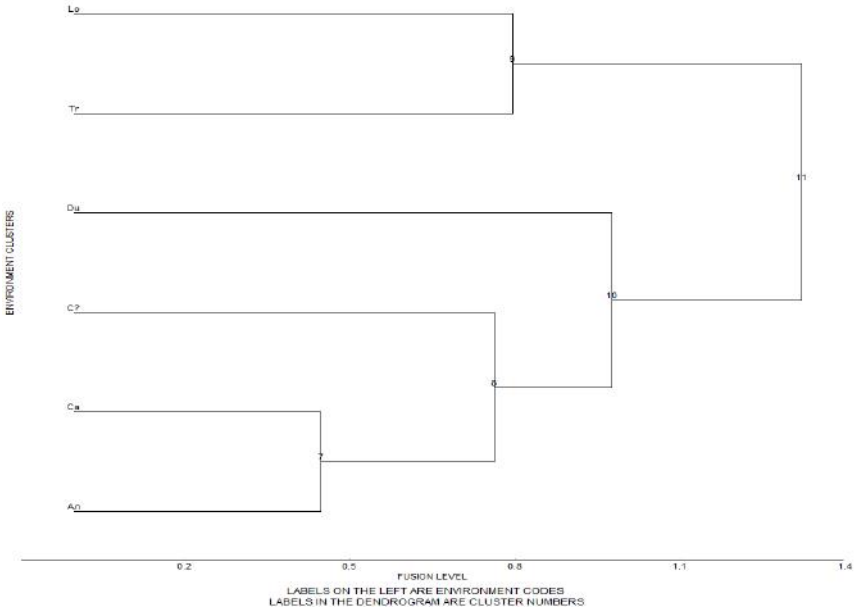


*Fig.2: Environmental grouping in the 2023 Winter-Spring crop*

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https://dx.doi.org/10.22161/ijeab.94.23

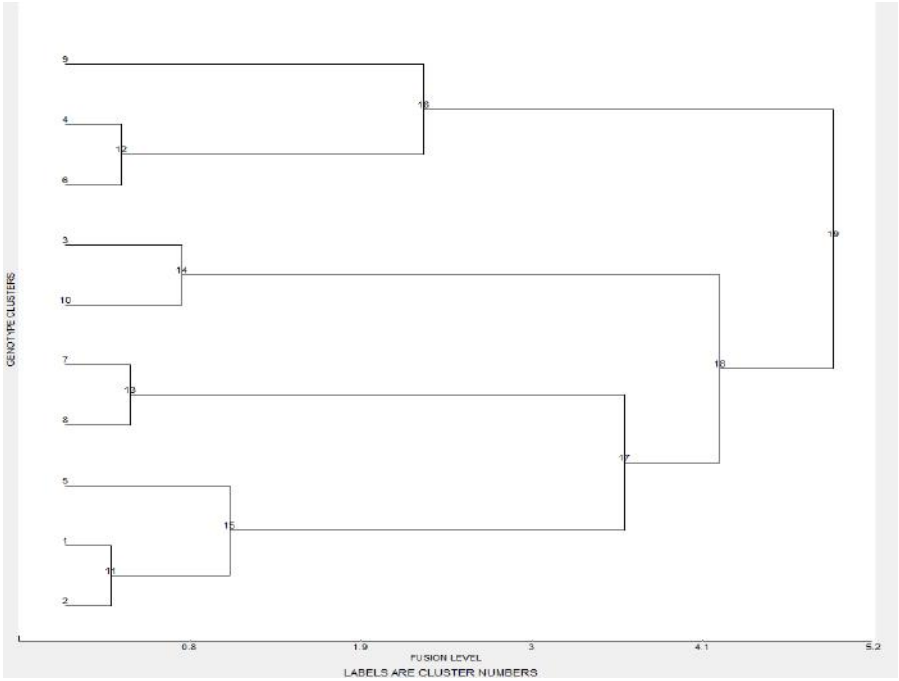


*Fig.3: Genotype grouping for Winter-Spring crop 2023*

❖ **Results recorded in Summer-Fall crop 2023**

Through the analysis of the AMMI diagram, it shows that the interaction level of yield on 6 points reached 84.2%, which is very high. The analysis of the diagram shows that the peanut variety HATRI 06 DP is a very stable variety, followed by the variety HATRI 14 DP. Varieties such as HATRI 03 DP, HATRI 13 DP, HATRI 20 DP have positive interactions with the environment.

Based on the AMMI diagram, it is noted that the varieties HATRI 06 DP, HATRI 13 DP and HATRI 15 DP are suitable for Tra Cu and the varieties HATRI 15 DP and HATRI 20 DP are suitable for Cau Ngang area, the varieties HATRI 02 DP and HATRI 01 DP are suitable for Duyen Hai area. HATRI 16 DP, HATRI 02 DP are suitable for Long An area.

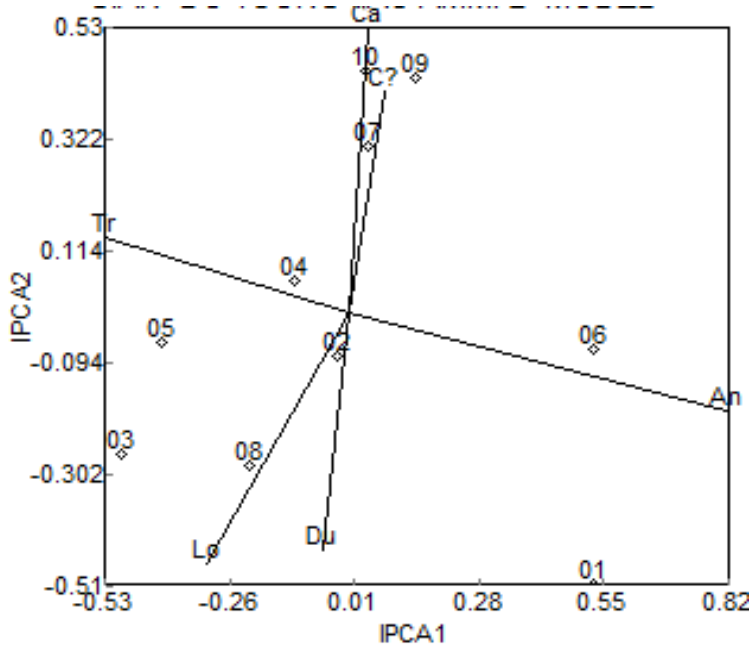


*Fig.4: Yield interaction level above 6 points in Summer-Autumn crop 2023 Interaction AMMI 2 MODEL*

Note: 1: HATRI 01 ĐP; 2: HATRI 02 ĐP; 3: HATRI 03 ĐP; 4: HATRI 06 ĐP; 5: HATRI 13 ĐP; 6: HATRI 14 ĐP, 7: HATRI 15 ĐP; 8: HATRI 16 ĐP; 9: HATRI 20 ĐP; 10: MD7.

***Variance analysis of AMMI model in Summer-Autumn crop 2023***

ANALYSIS OF VARIANCE FOR THE AMMI MODEL

| SOURCE | D.F. | S.S. | M.S. | F | FPROB |
|---|---|---|---|---|---|
| TREATMENTS | 9 | 1.37896 | 0.153218 | | |
| LOCATIONS | 5 | 150.796 | 30.1593 | | |
| TREATMENT X SITES | 45 | 2.30523 | 0.512274E-01 | | |
| AMMI COMPONENT 1 | 13 | 1.10165 | 0.847419E-01 | 2.253 | 0.031 |
| AMMI COMPONENT 2 | 11 | 0.840203 | 0.763821E-01 | 4.414 | 0.002 |
| AMMI COMPONENT 3 | 9 | 0.164686 | 0.182985E-01 | 1.105 | 0.426 |
| AMMI COMPONENT 4 | 7 | 0.108362 | 0.154803E-01 | 0.857 | 0.590 |
| GXE RESIDUAL | 5 | 0.903362E-01 | | | |
| TOTAL | 59 | 154.481 | | | |

Genetic grouping based on the yield of peanut lines as well as the cultivation locations was carried out in this crop to classify the genotypes and environments corresponding to each genotype that gives the best cultivation efficiency. The results of genetic grouping are expressed in terms of genotypes at a difference of about 30%, the lines/varieties are divided into 3 main groups: Group I includes 6 lines: HATRI 16 DP, HATRI 02 DP, HATRI 06 DP, HATRI 14 DP, HATRI 15 DP, HATRI 20 DP (high yield group); Group II has 2 lines with lower yield: HATRI 01 DP and MD7; Group III has 2 lines: HATRI 03 DP and HATRI 13 DP, this is the low yield group. Regarding the cultivation environment, at a difference of about 57.6%, there are five different environmental groups. Group I includes 2 locations (Long An, Duyen Hai). Group II is An Giang and Tra Cu. Group III includes Can Tho and Cau Ngang.

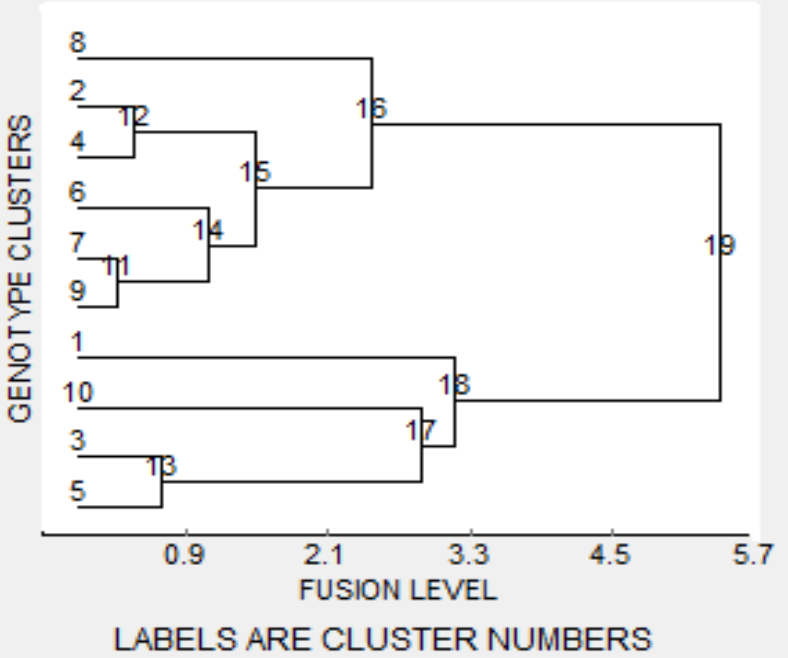


*Fig.5: Genotype grouping in Summer-Autumn crop 2023*

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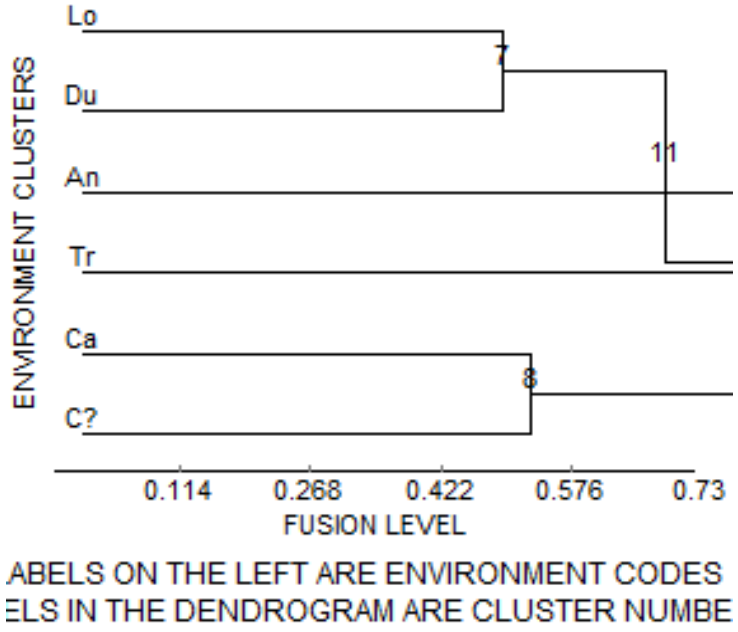


*Fig.6: Environmental grouping in Summer-Fall crop 2023*

## IV. CONCLUSION

Through analysis of the criteria for assessing adaptability and stability. Proposed varieties: HATRI 02DP, HATRI 03DP, HATRI 14DP meet the requirements for seed quality, yield and yield components, and high resistance to pests and diseases.

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