

BOOK 1

ISBN : 978-602-8915-93-9



ISNAR-C2FS 2011

International Seminar on Natural Resources, Climate Change and Food Security in Developing Countries

Proceeding



TABLE OF CONTENTS

Foreword	i – iv
Keynote Speech The Ministry of Agriculture Republic of Indonesia	v – xi
Table of Contents	xii – xviii
 Plenary Speakers	
1. Food Insecurity and Climate Change: The Roles of Private Sector in Overcoming The Changes Bustanul Arifin	1 – 13
2. Genetic Diversity, Climate Uncertainty and Food Security Hugo A. Volkaert	14 – 23
3. Exploring The Roles of Virtual Classrooms in Biodiversity Conservation Discourses: an Experiential Learning Perspective Ricardo T. Bagarinao	24 – 33
 Sub Theme : <u>Biodiversity and Conservation</u>	
Oral Presentation	
4. Fungus Diversity on Weeds And In Soil after Soybean Harvested Alfi Inayati and Kurnia Paramita	34 – 40
5. Conservation Status of Indigenous Trees in Argao River Watershed Reserve, Cebu Philippines: a local initiative Archiebald Baltazar B. Malaki and Inocencio E. Buot, Jr.	41 – 53
6. Structures and Shape Variations Of The Scales Of Quoy Parrotfish, <i>Scarus quoyi</i> (Valenciennes 1840) Arri Q. Adajar, Mark Anthony J. Torres and Cesar G. Demayo	54 – 69
7. Qualitative and Geometric Morphometric Description of The Shapes of Scales of Viridescent Parrotfish, <i>Calotomus viridescents</i> (Rüppell, 1835) Carlo Stephen Omar Moneva, Mark Anthony J. Torres, Sharon Rose M. Tabugo and Cesar G. Demayo	70 – 82
8. Describing Head Shape Variation Between Sexes and Among Two Colormorphs of The Rice Bug, <i>Leptocorisa oratorius</i> Fabricius, 1794 (Hemiptera:Alydidae) Clifford P. Bendoy, Mark Anthony J. Torres and Cesar G. Demayo	83 – 97
9. Genomic Fragment Gene of Carbonic Anhydrase (Ca) in <i>Flaveria bidentis</i> (C4 Photosinthetic Type) Didik Pudji Restanto	98 – 105
10. Biodiversity of Java Tea (<i>Orthosiphon Stamineus</i> Benth) Collected From Indonesia and Malaysia Dwi Susanto and Teng D. C. L.	106 – 115
11. Biodiversity of Salak Plant (<i>Salacca zalacca</i> (Gaertner) Voss) Hari Bowo and Sukartiningrum	116 – 126
12. Study on Saprophytic Phyloplane Antagonist Against Purple Blotch Disease on Onion Caused by <i>Alternaria porri</i> IN VITRO Hery Nirwanto	127 – 133
13. Assesment of the Utilization of Ex-Mining Area in East Java Province Kemal Wijaya	134 – 144
14. Carotenoids Content of Commercial Seaweed In Bali K. Sri Marhaeni Julyasih	145 – 151



- | | | |
|-----|---|-----------|
| 15. | Modularity, Covariation and Integration in the Hind Wings of Grasshopper in Family Acrididae
Kimverly Hazel I. Coronel, Mark Anthony J. Torres and Cesar G. Demayo, | 152 – 162 |
| 16. | Arthropods and Weeds Species Diversities on Post Soybean Harvested
Kurnia Paramita Sari and Alfi Inayati | 163 – 168 |
| 17. | Evaluation of Green Open Space Availability in Sleman District
Lis Noer Aini | 169 – 177 |
| 18. | Planning of Soil and Water Conservation on Several Land Use in Watershed Petanu, Gianyar
Made Sri Sumarniasih | 178 – 182 |
| 19. | Image Analysis of Intra-Population Variability In A Non-Outbreak Population Of The Rice Black Bug <i>Scotinophara</i> SP. From Tacurong, Sultan Kudarat, Philippines
Mark Anthony J. Torres, Geoffrey Reuel Quinaquin Yañez and Cesar G. Demayo | 183 – 193 |
| 20. | The Diversity of Epiphytic Orchid and its Host Tree Along Cemoro Sewu Hiking Pathway, Lawu Mountain, District of Magetan, East Java
Nina Dwi Yulia and Sugeng Budiharta | 194 – 202 |
| 21. | Species Diversity of Seagrasses in Camotes Islands, Central Philippines
Serapion N. Tanduyan, Berenice T. Andriano and Ricardo B. Gonzaga | 203 – 217 |
| 22. | Diversity and Habitat Profile of The Shallow Water Holothurians in Camotes Islands, Central Philippines
Serapion N. Tanduyan, Berenice T. Andriano, Ricardo B. Gonzaga, Panfilo E. Ciriaco, Wilfredo G. Anos, Lourdes M. Garciano | 218 – 229 |
| 23. | Effect of Land-Use Change on Diversity And Ecosystem Functions of Insects in Central Sulawesi and Its Conservation Effort
Shahabuddin | 230 – 238 |
| 24. | The Longevity of <i>Diaphorina citri</i> on Various Dominant Weeds
Siwi Hardiastuti and Mofit Eko Poerwanto | 239 – 244 |
| 25. | Morphological Characters of Kopyor Coconut Grown in Sumenep, Madura, Indonesia
Sukendah, Zainal Abidin, Sri Wiyatiningsih and Bakti Wisnu Wijayanti | 245 – 254 |
| 26. | Occurrence of Bacterial Soft Rot of <i>Phalaenopsis</i> Orchids in Yogyakarta and West Java, Indonesia
Tri Joko, Dwi Kiswanti, Hanudin and Siti Subandiyah | 255 – 265 |
| 27. | Macro Algae Diversity in Madura Island
Wisanti, Evie Ratnasari, Novita Indah Kartika | 266 – 275 |
| 28. | Land Snail Diversity of MT. Polis, Central Cordillera Range, Luzon Island, Philippines
Zenaída G. Baoanan and Steve P. Obanan | 276 – 293 |

Sub Theme : Biodiversity and Conservation
Poster Presentation

- | | | |
|-----|---|-----------|
| 29. | The Development of Nests <i>Collocalia esculenta</i> in Jombang, East Java
Novita Kartika Indah and Sunu Kuntjoro | 294 – 298 |
| 30. | Lake Danao, San Francisco, Central, Philippines: its Status and Government Initiatives for its Conservation and Sustainability
Serapion N. Tanduyan*, Berenice T. Andriano and Ricardo B. Gonzaga | 299 – 315 |



Sub Theme : Adaptation and Production
Oral Presentation

- | | | |
|-----|---|-----------|
| 31. | Study of Mango Plant Reproductive Phase's (Mangifera Indica.l)
Arumanis 143
Bambang Priyanto and W. Guntoro | 316 – 322 |
| 32. | Land Characteristics To Increase Sugar Content Of Melon Fruit (Cucumis melo)
Bakti Wisnu W, Purwadi and Siswanto | 323 – 339 |
| 33. | Soil Tillage Effect on Growth and Development of Root System of Ten Mango Seedling Varieties
Djarwatiningsih PS and Agus Sulistyono | 340 – 352 |
| 34. | Changes in Leaves and Stem Diameter of Cocoa Tree (Theobroma Cacao l.) in Drought Stress
Erma Prihastanti | 353 – 361 |
| 35. | Salinity Tolerance of Baluran Variety of Soybean (Glycine max. L) by in Vitro culture
Etty Handayani, Agus Nugroho Setiawan, Slamet Wahyudiyanto | 362 – 368 |
| 36. | Effect of Mulching by Corn Biomass on Growth and Production of Corn in Drought Condition
Denna Eriani Munandar | 369 – 376 |
| 37. | Effect of Fertilizer Mixed Macro Ammonium Sulfate Nitrate on The Growth And Production Shallot In Malang
Dwi Setyorini and Zaenal Arifin | 377 – 386 |
| 38. | Effect of Plant Strengthening Agents on Pak Choi Grown Organically
Farida | 387 – 392 |
| 39. | Molecular Analysis of Genetic Stability in Micropropagated Citrus Regenerated Through Somatic Embryogenesis Using Inter-simple Sequence Repeat (ISSR) Markers
Farida Yulianti, Nirmala F. Devy and Hardiyanto | 393 – 400 |
| 40. | Effect of Planting System to IP Rice 400 for Development of Pest Diseases
Handoko and Evy Latifah | 401 – 406 |
| 41. | Agronomic Aspects of Intercropping Between Energy Crop of Castor (Ricinus communis l.) and Pulses
I Komang Damar Jaya | 407 – 415 |
| 42. | Study of Preference of Diaphorina Citri Kuw.(homoptera : psyllidae) on Several Types of Orange Crops (citrus spp.)
Indriya Radiyanto and Ketut Sri Marhaeni J. | 416 – 422 |
| 43. | Study of Manure Addition (Biogreen and Fine Compost) on Za Fertilizer to Growth and Yield of Green Mustard
Juli Santoso and Yunia Ulfah | 423 – 428 |
| 44. | Developing High Yield and Tolerant to Low Nitrogen Tomato Genotypes
Makhziah and Ida Retno Moeljani | 429 – 437 |
| 45. | Nitrogen Use Efficiency and Yielding Ability of Four Maize Varieties
Makhziah and Yonny Koentjoro | 438 – 443 |
| 46. | Hybrid Vigor of Crossing Among Japanese and Indonesian Soybean
M. Setyo Poerwoko | 444 – 452 |
| 47. | Adaptation of Food Crops to Climate Change
Moch. Sodiq and Wiludjeng Widayati | 453 – 460 |
| 48. | Mass Propagation of Five Citrus Cultivars Through Somatic Embryogenesis Technique
Nirmala Friyanti Devy, Farida Yulianti and Hardiyanto | 461 – 471 |



49. Tolerance Levels of Ornamental Shrubs to Urban Air Pollution in Surabaya City Based on Air Pollution Tolerance Index (APTI)
Pangesti Nugrahani, Endang Tri Wahyu, Sugijanto and Hery Purnobasuki 472 – 479
50. Application of Organic Mulches on Cultivation of Red Pepper (*Capsicum annum*, L.) in different seasons
Puji Harsono and Dja'far Shiddieq 480 – 488
51. Qualitative and Quantitative Analysis of Scale Shape Variation Between Different Body Regions of Redbreast Wrasse (*Cheilinus fasciatus*)
Queenilyn B. Albutra 489 – 502
52. Influence of Planting Distance and Pruning on Growth and Development of Sengon (*Albizia Falcataria* L.)
Ramdan Hidayat, B.W. Wijayani and Sukendah 503 – 515
53. Agronomic and Physiological Responses of Maize Cultivarsto Low Nutrient Supply
Renih Hayati, Asmawati and Munandar 516 – 526
54. Determination of Efficiency in Extraction Anthocyanin of Teleng Flower (*Clitoria ternatea* L.)
Retno Endrasari, Pudji Hastuti and Sri Anggrahini 527 – 535
55. Rate and Time Nitrogen Application on The Growth and Yield of Two Varieties Oilseed Rape (*Brassica napus* L.)
Sigit Soeparjono 536 – 544
56. Resistance of 6 Shallot Cultivars to Moler Disease in Field
Sri Wiyatiningsih, Arif Wibowo, and Endang Triwahyu P. 545 – 552
57. Declining of Apple Production at Three Production Centers of East Java
Suhariyono 553 – 565
58. Chicken Manure Application to Improve The Growth of Paddy Grown on Critical Land of Ex-Brick Industry
Sundahri 566 – 572
59. Characterization of EGCG Compound Use ¹H NMR Spectrum on Camellia Sinensis (L.) Callus
Sutini, Tatik W, Sutiman B, and R. Verpoorte 573 – 578
60. Impact The Lapindo Mudflow toward Biosafety of Fisheries Product at East Coastal of Sidoarjo District
Tarzan Purnomo 579 – 589
61. The Effect of The Volume of Methyl Eugenol to Total Catch Fruit Flies *Bactrocera* (Diptera: Tephritidae)
Tjipto Haryono 590 – 594
62. Characteristic of Growth and Production of Oyster Mushrooms at Medium Land at Litter Media
Widiwurjani and Guniarti 595 – 603
63. Growth Pattern of Coffee Seeds on Various Water Potential Pressure
Yonny Koentjoro and Makhziah 604 – 613
64. Diversity Technology Strawberry Cultivation in Different Regional Production Centre
Zainuri Hanif and Emi Budiayati 614 – 626

Sub Theme : Adaptation and Production
Poster Presentation

65. Effect of Foliar Fertilizer Use on The Growth and Production Of Chinese Cabbage/ Caisim (*Brassica juncea*)
Al. Gamal Pratomo and Luki Rosmahani 627 – 640



- | | | |
|-----|--|-----------|
| 66. | Test The Effectiveness of Organic Fertilizer Super "Zoo-Mass" on the Growth and Yield of Mustard (<i>Brassica Juncea L.</i>)
Amik Krismawati and Dini Hardini | 641 – 654 |
| 67. | Application Integrated Crop Management Approach (PTT) New Variety of Rice in Rice Field Integration with Beef in Madiun Residen
Amik Krismawati and Setiasih | 655 – 667 |
| 68. | Improvement Feeding Management of Pre Weaning Twinning Calf in East Java
Dini Hardini, Hendri Arianto and Irfan HD | 668 – 673 |
| 69. | Potency of Twin Calving of Some Beef Cattle Local Breed In East Java
D. Hardini and Irfan HD | 674 – 678 |
| 70. | Fruit Fly Responses to Plant Type and Distillates Basil Plant on Mango
Eli Korlina, Diding Rachmawati, Luki Rosmahani and Sri Yunlastuti | 679 – 684 |
| 71. | Productivity and Quality of 6 Varieties of Superior Grapevine Plante at High Land of Tlekung (950 m asl)
Emi Budiayati and Anis Andrini | 685 – 693 |
| 72. | Determinants Factors in Technology Development with Internal Input Raw Materials Dirt Cow
Hadi Suhardjono and Yonny Koentjoro | 694 – 702 |
| 73. | Productivity of Three Dwarf Kopyor Coconut Varieties From Pati, Central Java – Indonesia
Ismail Maskromo, Hengky Novarianto, Sukendah, and Sudarsono | 703 – 711 |
| 74. | Simultaneous Infection of Mandarin (<i>citrus reticulata blanco.</i>) with Tristeza Virus and <i>Liberobacter Asiatus</i> in Indonesia
Mutia Erti Dwiastuti | 712 – 724 |
| 75. | The Assessment of Production And Resistance to Purple Spot Disease (<i>Altenaria Pori</i>) on Lines Shallot (<i>Allium cepa</i>) Potentially High Production
N. Istiqomah, E. Korlina, and Z. Arifin | 725 – 733 |
| 76. | Characteristic Agronomic Components and Organoleptic Test Eleven of Lines Paddy (<i>Oryza Sativa</i>)
N. Istiqomah and S.S. Antarlina | 734 – 743 |
| 77. | Application of Integrated Crop Management (ICM) to Increase Productivity, Revenue and Efficiency of Rice Farming
Purwanto and Suwono | 744 – 753 |
| 78. | Soybean Productivity Improvement through Innovation Technology
Q. Dadang Ernawanto dan Noeriwan B.S. | 754 – 763 |
| 79. | Adaptation of the Stem Structure Mangrove on the Est Coast Surabaya
Rinie Pratiwi, J. Djoko Budiono, Enny Susiywati and Nur Hidayah | 764 – 777 |
| 80. | Action Research of Feeding Fermentation Treatment Using Complete Local Raw Materials from Agricultural Waste to Fattening Sheep at Tulungagung District
Setiasih, A.M. Abdurrahman, D.W. Astuti and S. Purnomo | 778 – 785 |
| 81. | Upland Rice Production Test and Pest Disease Attack Rate
Sugiono and Zainal Arifin | 786 – 795 |
| 82. | The Source of Potassium Fertilizer and its Effect on The Increasing of Rice Yield in The Vertisol
Suwono and Purwanto | 796 – 806 |
| 83. | Evaluation of Picking Tool Application Assessment on Three Arumanis/Gadung Mango Plantations
Wahyunindyawati and Sri Harwanti | 807 – 814 |



-
- | | | |
|-----|--|-----------|
| 84. | The Growth of Leguminoceae in Calcareous Soil
Yuliani and Yuni Sri Rahayu | 815 – 828 |
| 85. | Improvement of Rice and Corn Cropping System
in One Cropping Pattern on Rainfed Lowland
Zainal Arifin, Sugiono and Dwi Setyorini | 829 – 840 |
| 86. | Improving Productivity of Jatropha More Than 30 Percent (>10 Ton/Ha)
Using Application of KNO ₃ To Flowering Faster (>30%) and Honey Bee Apis
Mellifera (Apidae) Pollination To Increasing of Fruit (>30%) on Dry Climate
of Dry Land
F. Deru Dewanti, Budi Hariyono and Agus Sulistyono | 841 - 846 |
| 87. | Benthic Meiofaunal Composition in Selected Sandy Substrates Along Pala-
O River, Iligan City, Philippines
Ifeche, A. A., M. A. D. Delos Angeles, F. I. V. Cabahug, J. A. R. S. Lopez,
A. S. Oliveros¹ And J. A. Godinez | 847 – 854 |
| 88. | Estimation of Primary Productivity and Periphyton Biomass in The Water
Reservoir of Agus Iv Hydroelectric Plant In Nangka, Balo-I, Lanao Del
Norte, Philippines (A High School Research Project)
Rona Kriszelle P. Jauculan and Jesha Faye T. Librea | 855 - 871 |
| 99. | LIST OF PARTICIPANTS | 872 - 885 |



HYBRID VIGOR OF CROSSING AMONG JAPANESE AND INDONESIAN SOYBEAN

M. Setyo Poerwoko

Faculty of Agriculture University of Jember, East of Java, Indonesia
setyopoerwoko@yahoo.com

ABSTRACT

The magnitude of hybrid vigor is normally presented in term of heterosis (H, superiority of the F_1 hybrid over than its parental mean) and heterobeltiosis (Hb, superiority of the F_1 hybrid over its better parent). The data were collected on averaged seed yield/plant, number of pod/plant, number of seed/plant, 100 seed weight, number of fertile node in main stem/plant, and plant height. Several cross showed heterosis over than the mid parent and better parent. Crosses showing heterosis for seed yield/plant also showed heterosis for number of pod/plant, number of seed/plant (UNEJ-1xKaohsiung). However, only Kaohsing x Malabar, and Malabar x UNEJ-2 for seed yield/plant expressed heterobeltiosis. Superiority over the mid parent for seed yield/plant ranged from 3% to 31%, and that over the better parent ranged from 2% to 58%. The highest heterosis over the mid parent was Malabar x UNEJ-2 and better parent was shown in the cross Kaohsing x Malabar. The best three hybrid selected for next generation selection (breeding for high yielding and early maturity) were *Kaohsiung-3* x Malabar, Malabar x UNEJ-2, Malabar x *East of Java-2*. In self pollinated crops, hybrid seed can be produced using a male sterile line as a female parent. The detected seed yield heterosis must be reasonably high to compensate for cost of seed production.

Key word: Heterosis, Heterobeltiosis, soybean, hybrid vigor

INTRODUCTION

Soybean, *Glycine max*, L. Merrill was a crucial source of protein in Indonesia. Soybean is a crop with a harvest ripe age between 70 to 85 days. The increase results mainly from an increase in harvest area. Increases in productivity result not easily achieved through an increase in acreage planted. The use of hybrid cultivars can increase the power limitations of the results of pure line cultivars. Hybrid varieties have contributed greatly to the increased production of various crops, including major food crops such as rice and corn. Commercial exploitation of heterosis is one of the strengths and extensive development on seed production. Heterosis breeding for results has been conducted on various crops, including cross-pollinated plants, and plant species at self-pollinated plants.

Exploitation of heterosis to increase productivity in legume seeds, as well as in other plants, relies on three main factors: (1) the amount of heterosis, (2) the



feasibility to produce hybrid seeds for large-scale production, and (3) type action of existing genes. Heterosis could improve yield, size, and number of plant parts, component-chemical components, and nature's resistance to disease. The hybrid is a type of crop produced from the merger of gametes is not the same as or derived from pairs of genes heterozygote for certain characters.

Heterosis and heterobeltiosis expressed in percentage without going through the tests of significance. If the standard error associated with each value was high, the high heterosis may be statistically not significant different, thus the data obtained did not meet the requirements of seed companies that produce commercial hybrid seed. The main obstacle to the utilization of heterosis in soybean is a crop that kleistogami properties, making it difficult in a crossover. If there is male sterility in plants (male sterile), then the utilization of heterosis will be easier. Potential heterosis in crosses between male and female parent would be better if the kinship between the two elders is increasingly distant. This is associated with the mechanism of heterosis due to the heterozygote alleles in hybrid offspring (F1). In this regard, the researcher tried to cross between Indonesian soy with soy Japan.

Based on the results of the study was first (Poerwoko *et al.*, 1998) have been obtained soybean genotypes Unej Unej-1 and-2 are high yielding and properties of soybean leaf rust resistance are moderate.

MATERIALS AND METHOD

The material used is the five soybean: (1) Unej-1, (2) Unej-2, (3) Variety Malabar, (4) Japanese Soybean cultivar Ryokkoh, R-75), (5) cultivar Kaohsiung-3, and (6) cultivar East of Java-2.

Genotype Unej-1 and Unej-2 is soybean germplasm of high yielding, rust resistant obtained from previous studies (Poerwoko, *et al.*, 1998). Malabar varieties are a source germplasm early age, while the Ryokkoh, R-75, Kaohsiung-3 and the East of Java-2 are edamame cultivars with large seed size (weight of 100 seeds on top of 20g). To assemble the hybrid method is used Griffing (1956) through diallel crossing 6x6.

The formula used to determine the value of heterosis and heterobeltiosis as used by Soehendi and Srinives (2005) as follows.



Significance testing of heterosis

For each F_1 cross, percent heterosis (%H) and heterobeltiosis (%Hb) for a particular trait were calculated as follows:

$$\%H = (\bar{F}_1 - \overline{MP}) \times 100 / \overline{MP}, \text{ and}$$

$$\%Hb = (\bar{F}_1 - \bar{P}_i) \times 100 / \bar{P}_i,$$

Where:

- \bar{F}_1 = mean observation of the F_1 progenies from the total of n_1 plants,
- \overline{MP} = mean observation of both parents from $n_2 + n_3$ plants, and
- \bar{P}_i = mean observation of the i^{th} parent from n_2 plants for P_1 , and n_3 plants for P_2 .

Significance of H and Hb were determined by a t-test as follows:

$$\text{t-test for H} = \frac{\bar{F}_1 - \overline{MP}}{S_H}, \text{ and}$$

$$\text{t-test for Hb} = \frac{\bar{F}_1 - \bar{P}_i}{S_{Hb}},$$

where S_H and S_{Hb} are the standard error of estimates of H and Hb which can be derived as shown in the attached note.

The degree of freedom (df) for each test was obtained by summing up the df of each generation involved in the estimate. Thus, the df for testing H is $(n_1-1)+(n_2-1)+(n_3-1)$, and the df for testing Hb is $(n_1-1)+(n_i-1)$, $i = 2$ or 3 , depending on whether the high parent is P_1 or P_2 .

Derivation (offspring) from the use of formulas and Heterobeltiosis Heterosis in accordance with the criteria according to Soehendi and Srinives, 2005, as follows

Note on derivation method for S_H and S_{Hb} .

$$H = \bar{F}_1 - \frac{(\bar{P}_1 + \bar{P}_2)}{2}$$

$$= \bar{F}_1 - \frac{\bar{P}_1}{2} - \frac{\bar{P}_2}{2}$$

Using the property of expectation (Steel and Torrie, 1980; Chapter 5, topic 5.10) then,

$$\text{Variance of H} = \text{Var} \left(\bar{F}_1 - \frac{\bar{P}_1}{2} - \frac{\bar{P}_2}{2} \right)$$

$$= V\bar{F}_1 + \frac{V\bar{P}_1}{4} + \frac{V\bar{P}_2}{4},$$

(assuming no covariation between generations),

$$= \frac{VF_1}{n_1} + \frac{VP_1}{4n_2} + \frac{VP_2}{4n_3}$$

$$= \frac{SSF_1}{n_1(n_1 - 1)} + \frac{SSP_1}{4n_2(n_2 - 1)} + \frac{SSP_2}{4n_3(n_3 - 1)}$$

Where $V\bar{F}_1, V\bar{P}_1,$ and $V\bar{P}_2$ are the variances of the mean of each generation; and $VF_1, VP_1, VP_2, SSF_1, SSP_1$ and SSP_2 are variances and sums of squares of the specified generations, respectively.

Then, the standard error of estimate of H (or S_H) = $\sqrt{\text{variance of H}}$

In the same manner, variance of Hb can be obtained from

$$\text{Variance of Hb} = \text{Var} (\bar{F}_1 - \bar{P}_i)$$

$$= \frac{VF_1}{n_1} + \frac{VP_i}{n_i} = \frac{SSF_1}{n_1(n_1 - 1)} + \frac{SSP_i}{n_i(n_i - 1)}$$

and $S_{Hb} = \sqrt{\text{variance of Hb}}$



RESULTS AND DISCUSSION

Observations for six agronomic properties elders, F₁ and F₁ reciprocal presented in Table 1 below.

Table 1. Yield and Yield Component of Agronomic Characters F₁ and Six Parents

No.	Genotype	Seed Yield Per Plant (g)	∑ pod Per Plant	∑ Seed Per Plant	100 Seed Weight	∑ Fertile Nodes	Plant height (cm)
1	UNEJ-1 (1)	4.95±1.14	60.31±18.53	54.00±21.25	8.55±0.00	8.00±3.08	49.50±8.93
2	UNEJ-2 (2)	3.18±0.87	35.04±10.85	43.20±19.57	8.16±0.00	9.60±2.73	53.76±6.97
3	Malabar (3)	8.27±2.50	72.75±13.50	105.50±54.4 ₃	9.25±0.00	11.50±1.66	51.38±7.44
4	Ryokkoh (4)	10.08±1.37	28.25±9.52	38.75±14.15	24.98±0.00	7.75±2.49	27.6±9.15
5	Kaohsiung 3 (5)	8.57±2.31	31.94±6.32	36.00±13.66	19.57±0.00	6.75±0.83	32.23±4.15
6	East of Java 2 (6)	10.04±2.96	24.44±1.55	32.22±6.28	25.30±0.01	5.33±1.70	28.80±17.13
7	1 x 2	3.93±0.48	60.12±19.88	31.79±9.22	5.09±0.00	13.45±4.55	80.5±6.5
8	1 x 4	10.24±0.00	74.00±0.00	144.00±0.00	8.28±0.00	13.00±0.00	69.00±0.00
9	1 x 5	7.57±2.12	42.95±2.95	75.81±7.67	11.89±0.00	8.75±0.43	56.08±10.57
10	2 x 6	2.65±0.00	100.00±0.00	70.00±0.00	3.79±0.00	15.00±0.00	85.00±0.00
11	3 x 1	5.72±1.45	121.56±30.94	81.2±24.5	10.30±0.00	12.80±1.17	74.61±6.91
12	3 x 2	12.74±1.65	86.75±6.94	112.25±22.5 ₇	12.17±0.00	9.75±0.43	63.00±13.97
13	3 x 6	13.93±1.11	95.44±7.67	178.33±31.2 ₆	11.05±0.00	15.33±1.25	59.24±4.08
14	4 x 2	6.57±1.93	43.56±15.35	32.89±7.34	21.21±0.00	6.40± 0.49	38.60±6.31
15	4 x 5	1.45±0.40	29.50±5.50	31.25±3.75	5.26±0.00	6.50±0.00	44.00±4.00
16	4 x 6	11.40±1.83	41.00±6.00	61.13±3.88	19.34±0.01	9.50±0.50	29.70±1.80
17	5 x 1	4.39±1.13	22.00±4.32	21.81±5.31	18.68±0.01	5.00±0.82	28.89±4.32
18	5 x 3	13.55±0.00	35.00±0.00	65.00±0.00	27.00±0.00	9.00±0.00	31.50±0.00
19	5 x 4	4.22±0.67	33.92±3.60	28.28±3.36	16.19±0.00	6.80±0.75	41.28±1.57
20	5 x 6	7.33±1.32	36.68±15.29	27.95±4.21	26.57±0.00	6.80±0.40	38.67±2.14
21	6 x 3	9.72±1.25	35.88±1.87	40.84±11.26	26.47±0.05	7.20±0.40	35.61±5.10
22	6 x 4	7.67±1.65	31.72± 6.02	33.81±10.01	24.10±1.43	7.25±1.09	32.33±5.29

Weight of seeds per plant for Unej-1, Unej-2, Malabar, Ryokkoh (R-75), Kaohsiung-3, and East of Java-2, respectively, 4.95, 3.18, 8.27, 8.10, 8.57, and 10.04 g / plants. Kaohsiung-3 x Malabar (15%), and Malabar x East of Java-2 (13%). Hybrids Malabar x Unej-2, besides having a mean value of heterosis based on both parent is high (31%), supported also by the value of heterosis pods per plant number (15%), number of seeds per plant (13%), weight of 100 seeds (10%) and plant height 5%). As for the nature of the number of fertile book, it turns out heterosis value (-2%), but this trait proved to have different degrees of closeness unreal Table 4, $r = 0.093ns$. F₁ and reciprocal F₁'s best in a row is Malabar x East



of Java-2 (13.93 g / plant), Kaohsiung x Malabar (13:55 g / plant), and Malabar x Unej-2 (12.74 g / plant). Furthermore, Table 2 presents the value of heterosis based on the average of the two mid-parents.

Table 2. *Heterosis (%) Above Mid-Parent Several Crossing for Six Agronomic Character*

No	Recombinants	Seed Yield Per Plant (g)	Σ pod Per Plant	Σ Seed Per Plant	100 Seed Weight	Σ Fertile Nodes	Plant height (cm)
1	1 x 2	-0.01	0.07	-0.09	-0.10	0.13	0.14
2	1 x 4	0.09	0.17	0.53	-0.13	0.16	0.20
3	1 x 5	0.07	-0.02	0.17	-0.04	0.05	0.09
4	2 x 6	-0.15	0.59	0.21	-0.19	0.25	0.26
5	3 x 1	-0.03	0.21	0.00	0.04	0.08	0.12
6	3 x 2	0.31	0.15	0.13	0.10	-0.02	0.05
7	3 x 6	0.13	0.24	0.40	-0.09	0.21	0.12
8	4 x 2	0.00	0.09	-0.05	0.07	-0.07	-0.01
9	4 x 5	-0.21	0.00	-0.04	-0.19	-0.03	0.12
10	4 x 6	0.03	0.14	0.18	-0.06	0.11	0.01
11	5 x 1	-0.09	-0.13	-0.13	0.08	-0.08	-0.07
12	5 x 3	0.15	-0.08	-0.02	0.22	0.00	-0.06
13	5 x 4	-0.14	0.03	-0.05	-0.07	-0.02	0.09
14	5 x 6	-0.05	0.08	-0.05	0.05	0.03	0.07
15	6 x 3	0.04	-0.07	-0.10	0.13	-0.04	-0.03
16	6 x 4	-0.06	0.05	-0.01	-0.03	0.00	0.04
Average		0.00	0.09	0.07	-0.01	0.05	0.07
Stand Dev.		0.12	0.16	0.18	0.11	0.10	0.09

1 = UNEJ-1; 2 = UNEJ-2; 3 = Malabar; 4 = Ryokkoh (R-75); 5 = Kaohsiung-3 (KS-3); 6 = East of Java-2 (EO-2)

Table 3. Yield and Yield Component of Agronomic Characters F_1 and Six Parents Presents (Table 1), the heterosis (Table 2) and the value heterobeltiosis in Table 3), and the value of the correlation between the six agronomic trait Table 4), then it can be determined at least one crossing who will be able to proceed to the assembly of new soybean varieties. Three hybrid combinations for each agronomic trait values in Table 3 indicated in bold (bold). Three hybrids with the highest value on heterobeltiosis best trait grain yield per plant, respectively, Kaohsiung-3 x Malabar (58%), Malabar Unej-2 (54%), and Malabar x East of Java-2 (39%).



Table 3. *Heterobeltiosis* (%) Six Agronomic Character Based on High Parent Several Crossing

No	Recombina nts	Seed Yield/ Per Plant (g)	Σ pod Per Plant	Σ Seed Per Plant	100 Seed Weight	Σ Fertile Nodes	Plant height (cm)
1	1 x 2	-0.21	0.00	-0.41	-0.40	0.40	0.50
2	1 x 4	0.02	0.23	0.85	-0.03	0.63	0.39
3	1 x 5	-0.12	0.01	0.40	-0.39	0.09	0.47
4	2 x 6	-0.74	1.85	0.62	-0.85	0.56	0.58
5	3 x 1	-0.31	0.67	-0.23	0.11	0.11	0.45
6	3 x 2	0.54	0.19	0.06	0.32	-0.15	0.17
7	3 x 6	0.39	0.31	0.69	-0.56	0.33	0.15
8	4 x 2	-0.35	0.24	-0.24	-0.15	-0.33	-0.28
9	4 x 5	-0.86	0.08	-0.19	-0.79	-0.16	0.36
10	4 x 6	0.13	0.45	0.58	-0.24	0.23	0.03
11	5 x 1	-0.49	0.64	-0.60	-0.05	-0.38	-0.42
12	5 x 3	0.58	0.52	-0.38	0.38	-0.22	-0.39
13	5 x 4	-0.58	0.06	-0.27	-0.35	-0.12	0.28
14	5 x 6	-0.27	0.15	-0.22	0.05	0.01	0.20
15	6 x 3	0.13	0.51	-0.61	0.05	-0.37	-0.31
16	6 x 4	-0.24	0.12	-0.13	-0.18	-0.06	0.12
Average		-0.15	0.16	-0.01	-0.19	0.04	0.15
Stand Dev.		0.41	0.55	0.46	0.34	0.31	0.32

1 = UNEJ-1; 2 = UNEJ-2; 3 = Malabar; 4 = *Ryokoh* (R-75); 5 = Kaohsiung-3 (KS-3); 6 = *East of Java-2* (EO-2)

Table 4. Correlation Matrix among Six Agronomic Characters

Agronomic Characters	Seed Yield/ Plant (g)	Pod/ Plant	Seed/ plant	100 Seed Weight (g)	Fertile Nodes	Plant Height (cm)
	1	2	3	4	5	6
1	1.000	-0.223 ^{ns}	0.510 [*]	0.478 ^{ns}	0.093 ^{ns}	-0.223 ^{ns}
2		1.000	0.698 ^{**}	-0.606 [*]	0.836 ^{**}	0.813 ^{**}
3			1.000	-0.402 ^{ns}	0.693 ^{**}	0.533 [*]
4				1.000	-0.637 ^{**}	-0.803 ^{**}
5					1.000	0.800 ^{**}
6						1.000

Table r (5%, db. n-2 = 0.497), r (1%, db. n-2 = 0.623) ns: non significance difference *: significance difference **: highly significance difference



Resume based on the results and discussion of Tables 1, 2, 3, and 4 are presented Table 5 as follows. On the basis of Table 5, the three best hybrids can proceed to further study, which is assembling a new high yielding soybean cultivars are Kaohsiung-3 x Malabar, Malabar x Unej-2, the Malabar X-2 East of Java.

Table 5. Crossing Combination, Rating of Three Best Hybrids Performance Based on Agronomic Properties, Heterosis Value, Value Heterobeltiosis, Total Score, and Hybrids Selected

Crossing Combination	Agronomic Performance	The Best Crossing		Total Score	Rank of Selected Hybrids
		Heterosis	Heterobeltiosis		
3 x 6	1	3	3	7	3
5 x 3	2	2	1	5	1
3 x 2	3	1	2	6	2

CONCLUSION

Based on research results and discussion, it can be deduced conclusions as follows.

1. Vigor of three best hybrids on the basis of mid parent is Malabar x Unej-2, Kaohsiung-3 x Malabar, and the Malabar x East of Java-2. While the basis of the best parent are Kaoh-siong-3 x Malabar, Malabar x Unej-2, and Malabar x East of Java-2.
2. Ranked of three hybrids are selected for use as material for the assembly of new high yielding soybean varieties are the Kaohsiung-3 x Malabar, Malabar x Unej-2, the Malabar x East of Java.

REFERENCES

- Bonde M.R., J.S. Melching, K.R. Bromfield. 1976. Histology of the Suspect Pathogen
- Relationship between *Glycine max* and *Phakopsora pachyrhizi* the Cause of Soybean Rust. *Phytopathology*. 66:1290-1294.
- Brown J.F. 1980. Mechanisms of Resistance in Plant to Infection by Pathogen. In Brown J.F., F.A. Kerr, F.D. Morgan and I.H. Parbery (Eds). *A Course Manual in Plant Protection*. Australian vice-chancellors Committee. pp.254-266.
- Griffing. B. 1956. Concept of General and Specific Combining Ability in The Relation to Diallel Crossing System. *Anst. J. Biol. Sci* 9: 463-493.



- Hardaningsih dan Soegito. 1994. Evaluasi Ketahanan Kedelai terhadap Penyakit Karat Daun. Hasil Penelitian Kacang-kacangan Anggaran APBN 1993/1994. Balittan Malang. p.161-168.
- Hardaningsih S. 1997. Reaksi Beberapa Genotipe Kedelai terhadap Jamur Karat (*Phakopsora pachyrhizi*). Prosid. PFI XIV dan Seminar Nasional. Palembang.
- Hartana. 1986. Pemuliaan Ketahanan Terhadap Penyakit Tanaman. Balai Penelitian Perkebunan Jember. Jember. 44p.
- Keen N.T. 1981. Evaluation of the Role of Phytoalexins in Staples R.C., G.H. Toenniessen (eds). Plant Disease Control. John Wiley and Sons. New York. Chichester. Brisbane. Toronto. pp.155-177.
- Kuchler F., M. Duffy, R. D. Shrum, W. M. Donler. 1984. Potential Economic Consequences of the Entry of an Exotic Fungal Pest: The Case of Soybean Rust. *Phytopathology*. 74:916-920.
- Marchetti M.A., F.A. Uecker, dan K.R. Bromfield. 1975. Uredial Development of *Phakopsora pachyrhizi* in Soybean. *Phytopathology*. 65:822-823.
- McLean R.J. 1979. Histological Studies of Resistance Soybean Rust *Phakopsora pachyrhizi* Syd. *Aust. J. Agric. Res.* 30: pp.951-956.
- Murdan. 1986. Studi Eksposi Masal Kematangan Reaksi Varietas Kedelai Terhadap Jamur Karat *Phakopsora pachyrhizi* Syd. Fakultas Pertanian Universitas Mataram. Mataram. 28p.
- Poerwoko, M.S., Widoyo, N. Sjamsijah, K. Bambang. 1995. Peningkatan Kuantitas dan Kualitas Hasil Kedelai dengan Pemuliaan. Laporan Penelitian Hibah Bersaing I/ 1 sampai dengan HB I/5. Lembaga Penelitian Universitas Jember.
- Poerwoko, M.S., E.B. Trisusilowati, G. Subroto, dan N. Sjamsijah. 1998. Introduksi Gen Ketahanan Karat Daun, *Phakopsora pachyrhizi*, Syd. Ke dalam Kultivar yang Telah Beradaptasi. Laporan Penelitian Hibah Bersaing VIII. Lembaga Penelitian Universitas Jember.
- Purwantoro, E.B. Trisusilowati, A. Tjahyani, M.S. Poerwoko. 1998. Laju Perkembangan Penyakit Karat Daun (*Phakopsora pachyrhizi* Syd.) pada 35 Genotipe Kedelai. Skripsi. Fakultas Pertanian UNEJ. Jember.
- Rytter J.L., W.M. Dowler, and K.R. Bromfield. 1984. Additional Alternative Host of *Phakopsora pachyrhizi* Causal Agent of Soybean Rust. *Plant Disease*. San Francisco. 238p.
- _____. 1991. Hubungan Antara Kerapatan Inokulum dan Cuaca dengan Tingkat Serangan Penyakit Karat (*Phakopsora pachyrhizi* Syd.) pada Tanaman Kedelai. Prosid. Lokakarya Penel. Komoditas dan Studi Khusus. pp. 438-493. A Course Manual in Plant Protection. Australian Vice-Chancellors Committee. pp.83-103.
- Semangun, H. 1990. Penyakit-Penyakit Tanaman Pangan di Indonesia. Gadjah Mada University Press. Yogyakarta. 514p.



- Sinaga M. 1978. Studi Mengenai Beberapa Macam Sumber Inokulum *Phakopsora pachyrhizi* Syd. Penye-bab Penyakit Karat pada Kedelai. Kongres PFI V. Malang. 5p.
- Singh, R.K., and B.D. Chaudhary. 1979. Biometrical methods in quantitative genetics analysis Kalyani Publis-hers.Ludhiana. India.
- Soehendi, R. and P. Srinives. 2005. Significance of Heterosis and Heterobeltiosis in F1 Hybrid of Mung-bean (*Vigna radiata* (L.Wilczek) for Hybrid Seed Production. *Sabrao J.* (2): 97-105.
- Somaatmadja, S. 1974.Pemuliaan kede-lai, *Glycine max* (L.) Merrill. Laporan Latihan Kacang-kacangan. LP₃ Bogor.
- Stansfield, W.D. 1983. *Genetics. Schaum's Outline Series.* McGraw-Hill Book Company. New York.
- Sudhanta I.M. dan H. Prayitno. 1987. Reaksi Varietas dan Umur Kedelai Terhadap Penyakit Karat. Prosid. Kongres PFI X. pp.421-426.
- Tszchanz A.T. and S. Shanmugasundaram. 1985. Soybean Rust. Proc. World Soybean Research Conference III. Westview Press. London. pp.562-567.
- Yech C.C. 1983. Differential Reaction of *Phakopsora pachyrhizi* on Soybean in Taiwan. *Proc. of a Symposium Tsukuba. Japan.* The Asian Vegetable Research and Development Center. Shanhua. Taiwan. Cina. pp.27-250.

