Agronomic Characteristics and Yield Potential of Promising Maize Hybrids in Dryland Agroecosystems of Western Nusa Tenggara

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Abstract. Maize is a major crop in Nusa Tenggara Barat (NTB) province of Indonesia. It is mainly cultivated in dryland areas during the rainy season. With demand increasing nationally, the prospects for maize cultivation are promising. To raise productivity in order to meet this growing demand, use of hybrids with high yield potential is needed. Therefore, evaluation of the suitability of new hybrids/inbred lines for dryland agriculture is necessary before they are released to farmers. The objective of this study was to assess the potential yield of hybrids of harapan grown in dryland agroecosystems. The study was carried out in Perigi village in Suela subdistrict, Lombok Timur, during the 2005/2006 rainy season. The location is a center of dryland maize production. Fourteen hybrids were tested using a randomized complete block design with four replications. For control purposes, Bima-1 and BISI-2 hybrids were used. Each plot consisted of 2 rows 5 m long with 0.75 × 0.20 m plant spacing. Of the 14 tested hybrids, 4 more grain yield than the controls. These include Nei92002/Mr4 (9.22 t ha^{-1}), Mr4/B11-209 (8.95 t ha^{-1}), G193/Mr4 (8.53 t ha^{-1}) and B11-136/Mr14 (8.30 t ha^{-1}). To know more about these hybrids, further tests are needed at several locations, both drylands as well as lowlands, before they are released commercially.

Key words: Maize, yield potential, hybrid, dryland

Introduction

Maize is an important commodity in Nusa Tenggara Barat (NBT) province because it has a strategic role in meeting the food needs of the people and the demand of feed industries in the region. Maize harvested area in the province in 2005 was 39 380 ha, with an average productivity of 2.45 t ha^{-1} (AANTB 2005), which is less than the national productivity (3.1 t ha^{-1}) (Directorate General of Food Crops 2005). The introduction of superior hybrids has contributed to improvement of maize productivity at both regional and national levels. However, dissemination and adoption of the introduced materials has been slow.

Besides higher yield, hybrids have several advantages like tolerance to pests and diseases, greater response to fertilizers, more homogenous growth and uniform ears, and higher number and heavier grain (Jugenheimer 1985). However, the environmental conditions for maize farming are highly varied across locations to which hybrids tend to be sensitive. Soemartono (1995) reported that to improve maize production in this region, hybrids tolerant to heterogeneous environments are needed.

A good number of hybrids have been developed in Indonesia in addition to those brought in from other countries. However, before hybrids are commercially released, they must go through a series of evaluations for yield and adaptability in comparison to existing well-adapted hybrids.

Materials and Methods

This study was carried out in Perigi village in Suela subdistrict of Lombok Timur district during the rainy season of 2005/2006. The experimental location was characterized by dryland agriculture under arid climatic conditons. The study was arranged in a randomized complete block design in which 14 hybrids were replicated four times. These hybrids were compared with two hybrid controls (Bisi-2 and Bima-1). Each hybrid was grown on a two-row plot 5 m long with 75 × 20 cm spacing. Two seeds per hill were sown which were thinned to 1 at two weeks of sowing.

About 38 kg N, 36 kg P_2O_5 and 30 kg K_2O were applied per plot. The main fertilization was done 7 days after planting using 1/3 of the dose of N and the full dose of P_2O_5 and K_2O as basal dressing. The remaining N was applied at one month after sowing. The sources were urea, SP-36 and KCl. Weeding was done twice, first at two months after planting and the second at 4 months after planting, during which heaping (earthing-up) was done. Plots were

kept free of pests and diseases. Irrigation was given once every 2-3 weeks considering the soil moisture. Harvesting was done when seeds showed the symptoms of physiological maturity or when the maize husk turned yellow-brown.

The agronomic traits recorded were plant height, ear height, male and female flowering, number of harvested plants and number of harvested ears per unit area, plant aspects, husk cover, ear aspects and production. The quantitative data were analyzed by computing analysis of variance (ANOVA) using Genstat (Discovery version 3) for each set of data. The LSD was computed to compare treatments.

Results and Discussion

Table 1 shows data on summarized agronomic traits like flowering, plant height, height of ear position and productivity of the hybrids. Analysis of plant height observations showed significant differences among the tested hybrids. Mr4/B11-209 hybrid (237 cm) had the tallest plant height and B11-209/Mr14 (128 cm) the tallest ear position. Plant height was closely related to biomass production. The ear position could also ease the harvesting and enabled youngsters to participate in the harvest.

The male and female flowering ranged from 54 to 58 days and 55 to 59 days, respectively.

We detected a variety effect on grain yield. Nei92002/Mr4 produced the highest grain yield (9.22 t ha^{-1}). The other higher-yielding hybrids were Nei92002/Mr4 (9.22 t ha^{-1}), Mr4/B11-209 (8.95 t ha^{-1}), G193/Mr4 (8.53 t ha^{-1}) and B11-136/Mr14 (8.30 t ha^{-1}). These hybrids could be promoted in NTB. Subandi (1985) reported that genotype-environment interaction leads to better selection. Some genotypes are good in certain environments but not in others.

The effective plants and number of ears per plot ranged from 46 to 48 and 45 to 48, respectively (Table 2). It means that some plants had 2 ears per plant (prolific).

Almost all the tested hybrids were good with respect to ear aspects, ear height, husk aspects and tolerance to pests or diseases.

In terms of yield, Nei9008/Mr 14 (14.3%) and B11-209/Mr14 (11%) were better than the control Bima-1, and Nei9008/Mr14 (12.3%) and B11-209/Mr14 (9%) were better than the control BISI-2 (Table 3). Some of the hybrids were, however, inferior to the controls: E54-2/Mr14, Mr4/B11-132, B11-132/MR14, etc.

Table 1. Summary of agronomic traits of hybrids tested on dryland at Perigi, Lombok Timur in Nusa Tenggara Barat province of Indonesia, rainy season 2005/2006.

Line/variety	Flowering age (day)		Plant height (cm)	Ear height (cm)	Grain yield (t ha^{-1})
	Male	Female			
Nei92002/Mr4	55	56	217	113	9.22
E54-2/Mr14	56	57	224	116	7.28
CML 165/Mr4	54	56	218	108	7.81
E45/Mr14	57	58	205	103	7.64
B11-209/Mr14	57	58	239	128	7.83
B11-126/Mr14	58	59	221	118	7.59
G180/Mr14	55	56	233	117	8.13
Mr4/B11-132	54	55	231	123	7.55
CML 431/Mr14	55	56	234	121	8.23
B11-157/MR14	57	58	233	120	7.70
B11-136/Mr14	55	56	223	125	8.30
Mr4/B11-209	57	58	238	125	8.95
G193/Mr4	57	58	226	122	8.53
B11-132/MR14	55	56	223	112	7.56
Bisi-2 (control)	56	57	242	137	8.07
Bima-1 (control)	55	57	233	119	8.21
CV (%)	1.5	1.6	3.4	4.9	6.6
LSD_{05}	1.22	1.31	11	8.4	0.75

Table 2. Summary results of number of plants, ears, husk and ear aspects of several hybrids grown on dryland at Perigi, Lombok Timur in Nusa Tenggara Barat province of Indonesia, rainy season 2005/2006.

Hybrid	No. of harvested plants per plot	No. of harvested ears per plot	1000-grain weight (g)	Husk aspect (1-5 scale[1])	Ear aspect (1-5 scale)
Nei92002/Mr4	48	48	40	1.00	1.00
E54-2/Mr14	47	47	38	1.50	1.50
CML 165/Mr4	46	46	35	2.00	1.25
E45/Mr14	48	48	35	1.25	2.00
B11-209/Mr14	46	46	35	1.25	1.00
B11-126/Mr14	46	45	38	1.00	1.50
G180/Mr14	48	47	37	1.25	1.25
Mr4/B11-132	49	47	38	1.50	2.00
CML 431/Mr14	48	47	38	1.00	1.00
B11-157/MR14	47	48	35	1.00	1.50
B11-136/Mr14	47	47	35	1.25	1.25
Mr4/B11-209	48	49	39	1.50	1.00
G193/Mr4	48	47	36	1.50	1.25
B11-132/MR14	47	48	38	1.25	1.75
Bisi-2 (control)	48	48	38	1.25	1.25
Bima-1(control)	47	47	39	1.00	1.25
CV (%)	2.4	4.3	3.8	-	-
LSD 5 %	1.65	2.86	7.20	-	-

[1.] 1= best and 5 = worst.

Conclusions

- The tested hybrids were relatively similar in plant height and ear length.
- Of the 14 tested hybrids, six were higher yielding than the controls. They include Nei92002/Mr4 (9.22 t ha^{-1}), Mr4/B11-209 (8.95 t ha^{-1}), G193/Mr4 (8.53 t ha^{-1}), and B11-136/Mr14 (8.30 t ha^{-1}).
- These hybrids need to be further tested for wider adaptation and promoted accordingly.

Table 3. Comparative yield benefit (%) of experimental hybrids over two controls Bima-1 and BISI-2.

Hybrid	Production (t ha^{-1})	% relative to Bima -1	% relative to BISI-2
Nei92002/Mr4	9.22	114.3*	112.3*
E54-2/Mr14	7.28	88.7	88.7
CML 165/Mr4	7.81	96.8	95.1
E45/Mr14	7.64	94.7	93.0
B11-209/Mr14	7.83	97.0	95.4
B11-126/Mr14	7.59	94.0	92.5
G180/Mr14	8.13	100.7*	99.0
Mr4/B11-132	7.55	93.6	91.9
CML 431/Mr14	8.23	100.2*	100.2*
B11-157/MR14	7.70	95.4	93.8
B11-136/Mr14	8.30	101.1*	101.1*
Mr4/B11-209	8.95	110.9*	109.0*
G193/Mr4	8.53	105.7*	103.9*
B11-132/MR14	7.56	93.7	92.1
Bima 1	8.07	100.0	-
Bisi 2	8.21	-	100.0

* Better than controls Bima-1 and Bisi-2.

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