Prospects and Potential of Hybrid Maize (*Zea mays*) Seed Production through CM 212 X CM 153 Parents (Vivek-17) in Bihar

Sanjeev Kumar, H. S. Gupta**, Manibhushan*** & S. K. S. Raghav****

A trial was conducted to explore the possibility of hybrid seed production of maize in the eastern region of the country and for characterization of male (CM212) and female (CM 153) parents during winter season of 2005-2007 at Sabajpura farm of ICAR Research Complex for Eastern Region, Patna (Bihar) in joint collaboration with VPKAS, Almora (Uttranchal). The results emphasized that there is enough opportunity of hybrid maize seed production in the eastern region and that too in Bihar provided all the seed production measures are taken into consideration and carried carefully. Characterization of male and female parents (lines) was also done based on their phenotypic characters and that is more appropriate in farmer's view. Based on the results in the year 2005-06, a seed yield of hybrid maize Vivek-17 (1.1 t/ ha) was recorded with 4.0 q/ ha of additional male seeds and in the year 2006-07, a seed yield of 1.4 t/ ha was recorded with 4.8q/ ha additional seed yield of male lines from 10th November sown crop.

NTRODUCTION

eed research holds the key for sustained growth in crop yields. Seed sector is heavily dependent on esearch which has to provide continue supply of improved seeds to keep place with growing equirement. So far more than 3000 varieties of different crops have been identified under the Seed ct, 1966 at national level. Seed is the most cost efficient means of increasing agricultural production nd productivity. Improved seeds have a special place amongst all inputs required for agricultural roduction. The use of inputs like irrigation, fertilizers, pesticides depends on rainfall situation. his is not with of improved seeds. The farmers plan and commit themselves purchase to the mproved seed much in advance on set of season. The seed production and distribution planning is hus different and much more important to the farmers. Till early fifties, most of the farmers used o be largely independent in respect of seed. Taluka seed multiplication farms were established in he IInd Five Year Plan with an object of producing foundation seed to be multiplied on farms of egistered seed growers and made available to the farmers for general cultivation. With the advent f hybrid technology, the seed scenario changed radically.

In Bihar, maize is grown in about an area of 6000 ha (mostly in winter season) which ranks first both area and production in the country but farmers are forced to purchase seeds from out side urces at very high prices as there is paucity of certified maize seed availability in the state and no ed production programme has been launched till date even there is enough potential of maize

Senior scientist (Agronomy), ICAR-RCER, Patna, **Director, VPKAS, Almora (Uttranchal), ***Scientist (SS) and ****Farm Manager, ICAR-RCER, Patna.

seed production in the state. So, keeping above points in view attempts have been made and trial on hybrid maize production was conducted with an objective of evaluating the performance of hybrid maize (Vivek-17) seed production (an early group of maize variety) in the state and also to characterize different vegetative and reproductive characteristics of male (CM 212) and female (CM 153) parents at the field level based on phenotypic behaviour of the parents which is also more realistic in view of farmers point.

MATERIALS AND METHODS

The trial was conducted at Sabajpura farm of ICAR Research Complex for Eastern Region, Patna in joint collaboration with Vivekanand Parvatiya Krishi Anushandanshala (VPKAS), Almora (Uttranchal) in winter season for two consecutive years (2005-2007) in an area of 0.5 ha with two dates of sowings in both the years. The soil type of the field was silty clay loam, pH 7.3 and E.C. 0.026ds/m with B.D. of 1.47g/cc. Available nitrogen, available Phosphorus and available Potassium was 290kg/ha,32 kg/ha and 398 kg/ha respectively, while Organic Carbon content in the soil was recorded 0.64 per cent. VPKAS had supplied the seeds of parent material (CM 153 X CM 212) i.e. Vivek-17 for multiplication which is a single cross hybrid. The variety comes under early maturity group in winter and extra early maturity group in Kharif. The trial was laid out with two dates of sowings 25th October and 10th November in 0.25 ha for each dates of sowing and an isolation distance of 400m² was maintained to avoid pollination from the local/foreign pollens. Female line CM 153 and male line CM 212 were sown in the field in the ratio of 2:1 with a spacing of 60 X 20 cm. A male line was also planted all around the boundary of the field. Roughing of off- type plants and weeding were completed before the tasseling of both the parent. Female plants were detasseled before the opening of tassel to avoid self pollination. All other agronomic and plant protection measures were taken as per the seed certification standards and recommendations for maize. At the time of harvesting female and male lines were harvested separately to avoid any seed-mixture. Shelling was done manually to avoid any mechanical damage and seeds were graded as per the seed certification standards and were stored at 10-12 per cent moisture.

RESULT AND DISCUSSION

Frequency of Seed Replacement

Farmers change their variety, intentionally or not, replacement of seed may be obtained from various sources. These sources differ depending on the type of material, the proximity of the formal seed system and the personal circumstances of the farmers. Subsistence oriented farmers who grow local varieties in marginal environments mainly for home consumption will generally rely on different sources of maize seed than commercial farmers. In remote areas, featuring mainly subsistence–oriented agriculture, when farmers change varieties, the change often involves replacement of one landrace by another. Landraces tend to be replaced with other land races, with seed usually being obtained from the community/friends/relatives etc. The popurality of this farmer- produced seed stems from the fact that it tends to be inexpensive of known quality and well adapted to local conditions (Almekinders *et al*, 1994). Frequencies of replacement of improved maize seed in different states are presented in table 1.

Table 1
Frequency of Replacement of Improved Maize Seed (% of Farmers)

	Frequency of maize seed replacement			
State	*Replace annualy*	*Replace every 2-3 years*	*Replace every 4 years or more*	*Never replace*
Andhra Pradesh	79	10	3	8
Bihar	74	13	3	10
Karnataka	85	7	3	6
Madhya Pradesh	4	14	14	68
Rajasthan	4	13	13	71
Uttar Pradesh	6	17	17	60
Total (6 States)	42	12	12	38

Source: Singh and Morris (1997).

Seed Recycling

It was found that seed recycling is common, especially in many developing countries in which farmers lack access to reliable sources of commercial seed, what is unexpected is to discover that seed recycling apparently extends in many cases to hybrids because of the phenomenon of inbreeding depression, progeny of F1 hybrids tend to under perform their parents. For this reason, hybrid seed is not recommended for recycling. But in recent years as maize hybrids have generally spread throughout the country, evidences has begun to accumulate that some farmers are choosing to ignore the recommendation that hybrid seed be replaced at each planting and of purchasing fresh seed for each new crop cycle, they plant advanced–generation hybrid seed (Ekboto *et al*, 1996). Sources of maize seed for sowing in selected states are presented in table 2.

Table 2
Sources of Maize Seed in Selected States (% of Seed)

	Maize seed procured from			
State	*Own harvest*	*Other farmers*	*Private trader*	*Government agency*
Andhra Pradesh	8	1	84	7
Bihar	15	2	77	6
Karnataka	5	1	73	20
Madhya Pradesh	64	3	14	19
Rajasthan	69	6	13	12
Uttar Pradesh	67	10	9	14
Total (6 States)	38	4	45	13

Source: Singh and Morris (1997).

Characterization of Male (CM 212) and Female (CM153) line

Different vegetative and reproductive plant characters of both the parent were characterized separately based on plant phenotype and ideotype at each stages of crop cycle and summarized as in table 3 which is self explanatory and friendly in view of both researchers and farmers.

Table 3
Phenotypic Characteristics of Male (CM 212) and Female (CM 153) Lines

Sl. No.	Parameters	Phynotypic Characteristics	
		CM 212 (Male line)	CM 153 (Female line)
1.	Plant height (cm.)	175-180	155-160
2.	Stem colour	Green	Green
3.	Brace root colour	Green	Green
4.	Leaf colour	Green	Dark green
5.	Leaf surface	Smooth	Rough
6.	Leaf size	Medium	Medium, semi- dent
7.	Mid rib colour	White	Whitish
8.	Tassel size	Medium	Medium
9.	Tassel shape	Open	Open
10.	Glume colour	Purplish	Purple
11.	Anther colour	Purple	Purplish
12.	Silk colour	Pale green at emergence	Purple
13.	Husk colour	Light green	Green
14.	Husk cover	Average	Good
15.	Ear placement	Medium	Medium
16.	Ear shape	Cylindrical	Cylindrical
17.	Ear length (cm.)	20-21	16-20
19.	Ear girth (cm.)	14-16	12-14
20.	Kernel row per year	14, regular	12-14, regular
21.	Cob wood colour	White	White
22.	Grain colour	Yellow	Orange-yellow
23.	Grain texture	Semi-dent	Flint
24.	Grain shape	Flat	Flat
25.	Grain size	Small to medium	Medium
26.	Av. 1000-grain wt.(g)	245	275
27.	Days to 50% pollen shed	90-92	85-90
28.	Days to 50% silking	95-98	92-95
29.	Yield potential (q/ha)	25-27	28-30
30.	Seed to seed maturity	140-145 days	140-145 days

Yield

During the first year (2005-06), Vivek-17 which was sown on 25th October produced about 1.0 t/ha certified seeds while sown on 10th November produced 1.1 t/ha certified seeds but both were found lower than its potential seed yield (1.8-2.0t/ha). This might be due to the fact that av. minimum temperature in the month of Dec.- Jan. was around 7°c which resulted in stunted vegetative growth and again in the month of March, 06 temperature rised abruptly leading towards the forced maturity and poor pollination which resulted in poor seed setting in the cob. Beck D., 1999 also reported similar findings.

In the second year (2006-07), 25th October sown crop produced 1.2t/ha certified seeds while sown on 10th November produced 1.4t/ha of certified seeds but again it was found lower than the potential of the variety. Here, the reason behind is due to unsynchronized tasseling and silking in male and female lines leads towards poor seed set while it was further studied that male line require more days for tasseling (atleast 10-15 days) than female lines for silking. The difference is more pronounced in early sown crop i.e. 25th October sowing. The results are presented in table 4.

Table 4
Certified Seed Yield of Hybrid Maize Vivek-17 During 2005-07

Year (s)	Dates of sowing	
	25th October	10th November
	Av. Yield (t/ha)	
2005-06	1.0 t/ha	1.1 t/ha
2006-07	1.2 t/ha	1.4 t/ha

CONCLUSION

Based on the results it is imperative to say that the seed of Vivek-17 can be produced in the eastern part of the country and that too in Bihar provided male lines should be sown atleast 10 days before the sowing of female one for synchronization in tasseling and silking between the lines and further, experiments on date of sowing for seed production in maize should be conducted to harness the potential yield of the variety and returns too.

Refrences

Almekinders C. J. M., Louwaars N. P. and Bruijn G. H. (1994), Local Seed Systems and their Importance for an Improved Seed Supply in Developing Countries. *Euphytica* 78: 207-216.

Beck D. (1999), Management of Maize Seed Production Fields. In : Maize Seed Production Manual, 13-15, September, 1999, Nairobi, Kenya, CIMMYT, INT.

Choto C., Sain G. and Montenegro T. (1996), Oferta y demanda de semilla mejorada de maíz en El Salvador. Publicaci n T cnica de Difusi n del Programa Colaborativo ICTA-PRM-CIMMYT.

Singh R. P. and Morris M. L. (1997), Adoption, Management and Impact of Hubrid Maize Seed in India. CIMMYT Economics Programme Working paper 97-05. Mexico, D. F.: CIMMYT.