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Short Communication

Cluster analysis in rapeseed (*Brassica napus* L.).

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Many oilseed crops (e.g. sunflower, soybeans, rapeseed/mustard, sesame, groundnuts etc) are grown in Kenya. But oilseed rape is preferred because of its high yields (1.5 tons – 4.0 tons/ha) with high oil content of 42 – 46%. It is soft seeded hence oil extraction is relatively easy. The meal is high in protein and very useful in livestock feed supplementation. The success of any crop improvement programme depends on the extent of genetic diversity in the material. Hence, it is essential to evaluate introductions for adaptation and study the similarities if any among them. Evaluation trials were carried out on 17 rapeseed genotypes (nine of Canadian origin and eight of European origin) at 4 locations in Kenya namely Endebess, Njoro, Timau and Mau Narok for two years. An analysis of variance was carried out on seed yields which indicated that the genotypes were significantly different (LSD, 0.05). Cluster analysis based on mean seed yields suggested only one major group existed within the material. In the first year, genotypes 2, 3, 8 and 9 didn't group with the rest. Genotype 8 was the only one that did not classify with the rest of the Canadian genotypes. Three European genotypes (2, 3 and 9) were however not classified with the others. In the second year, genotypes 10 and 6 didn't fall in the major cluster. Of these two, genotype 10 is of Canadian origin. Genotypes were more similar in the second year than the first year due to favorable weather. It is evident that genotypes from different geographical areas, that is, Europe and Canada fell in the same clusters suggesting that they have genetic similarity. The groupings indicated no correspondence between geographical diversity and clustering pattern.

Key words: Genetic diversity, cluster analysis, genetic similarity and cluster pattern.

INTRODUCTION

Oilseed rape is grown as a high quality source of vegetable oil for the food industry and supplies protein to the animal feed market. It is also seen as a key crop for raw material supply in the biodiesel (green diesel) industry. Despite the large potential for local production, Kenya is currently importing 90% of her vegetable oil requirement at a cost of Ksh. 14 billion annually. Many oilseed crops (e.g. sunflower, soybeans, rapeseed/mustard, sesame, groundnuts etc) are grown in Kenya. But rapeseed (*Brassica napus* L.) is preferred because of its high yield (1.5 tons – 4.0 tons/ha) and high oil content of 42 – 46%. It is soft seeded hence oil extraction is relatively easy. The meal is high in protein and very useful in livestock feed supplementation. Rapeseed encompasses very diverse types of plants, which are commercially important for edible oil in many countries. It can be grown grown in various cropping systems such as relay/inter-crops/cover crops, rotational crops, trap crops and for fodder. In Kenya, Rapeseed can be straight com-bined using adjusted wheat combines. Utilization of exo- tic germplasm is one way of broadening variation in a breeding programme (Vetelainen et al., 1996). Work done at the National Plant Breeding Research Centre – Njoro has shown that rapeseed is widely adapted in Ken-ya, and can be produced between 1800m a.s.l. and 2,700 m a.s.l. (UH2 –UH3). The success of any crop improvement program depends on the extent of genetic diversity available in the material (Yazdi –Samadi and Abe –Mishan, 1989). In an effort to increase genetic variation, Plant Breeders normally collect and evaluate large numbers of accessions from different parts of the world.

Genotype by environment interaction (G x E) reduces the rate of genetic improvement in crop plants and makes it necessary to test selections over several seasons and sites. Numerous statistical techniques have been pro posed to study G x E interaction. Cluster Analysis (CA) is a useful technique for describing differential yield repon-

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Table 1. Means of traits of rapeseed genotypes introduced from Canada and Europe.

Cultivar	Oil %	Protein %	Seed Yield kg/ha	
			First Year	Second Year
BN 009	42.6	18.2	1093cde	1783defgh
BN 013	43.7	18.6	1406abc	2054abcd
BN 008	42.1	17.8	1328abcd	1619fgh
BN 007	44.2	18.4	1241abcd	1743defgh
BN 012	43.3	18.6	1376abc	1890abcdefg
BN 003	44.5	18.1	1047de	2132ab
BN 015	43.8	18.6	1165bcd	1755defgh
BN 011	43.4	18.4	1440ab	2132ab
BN 001	44.7	19.6	1518a	1983abcd
BN 016	40.2	18.5	1253abcd	1616gh
BN 017	42.7	18.7	622f	2102abc
BN 006	44.6	18.3	1117cde	1934abcdef
BN 002	42.2	18.2	1178bcd	2172a
BN 010	42.0	18.5	1378abc	1853bcdefgh
BN 014	42.7	18.4	1020de	1619fgh
BN 004	45.0	18.6	849ef	1801cdefgh
BN 005	43.5	18.3	1104cde	1549h

First Year CV = 33% LSD (0.05) = 313kg/ha Second Year CV =21% LSD (0.05) = 318kg/ha Means within a column followed by the same letter are not significantly different LSD (0.05)

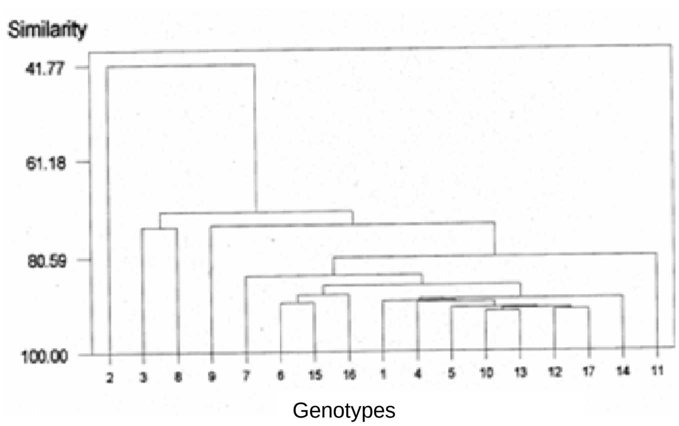

Figure 1. Cluster analysis based on seed yield in first year

ses of breeding lines grown in diverse environment even when the Joint Regression Analysis (JRA) shows non-significant heterogeneity of regression (Yau and Ortiz-Ferrara, 1994). Cultivar identification and discrimination has become an important issue in rapeseed breeding pr-grams (Mailer et al., 1997). Cluster analysis assigns genotypes into qualitative homogenous groups based on response similarities and also assists to classify genotypes. Whichever breeding strategy is chosen, stratification of environments is essential (Yau, 1991). The method is based on computation of Euclidean distances

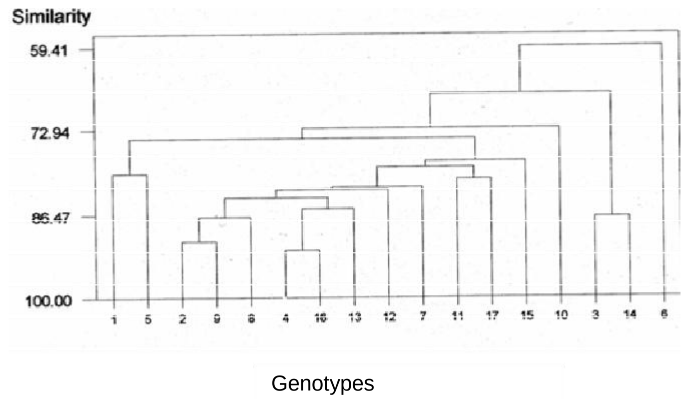

Figure 2. Cluster analysis based on seed yield in second year

among group means and produces a dendrogram showing successive fusion of individuals. In the dendrogram, genotypes are presented on the horizontal axis and the vertical axis shows the amount of Euclidean distances.

Greater heterotic effect is generated when clusters are divergent. This information complements the stability parameters. The study was undertaken to evaluate the adaptation of introduced genotypes and whether there exists genetic diversity between rapeseed of European and Canadian origin.

MATERIALS AND METHODS

An investigation was conducted to determine the adaptation and extent of diversity/relationships among rapeseed germplasm recommended for production in Kenya. Seventeen rapeseed (Canola types low in erucic acid and glucosinolates) from two sources that is, Canada (9) and Europe (8) were tested in multilocational trials at Njoro, Endebess, Timau and Mau Narok for two years. The experimental design was a Completely Randomized Block Design (RCBD) with 4 replicates. There were 8 rows per plot of 1.5 x 6.0 m. A wheat seeder was calibrated and used to seed the plots. The seed rate used was 8 kg/ha and fertilizer applied consisted of 9 kg N/ha and 23 kg P/ha. The trials were weeded twice manually. All the sites were rain – fed. Grain yield of entries were obtained from the 4 sites and analyzed across sites for each year. Oil and protein content of the seed was also established (Table 1).

RESULTS AND DISCUSSION

The Analysis of Variance (ANOVA) indicated significant differences in seed yields for all the entries across locations both in the first and second year (Table 1). Seed yields were generally higher in the first year than in the second year due to the good rains experienced in the latter.

In the dendrograms (Figures 1 and 2), genotypes are are presented on the horizontal axis and the Euclidean distances on the vertical. Based on cluster analysis, only one major cluster existed within the material. The dendro grams show successive fusion of group means. In the first year; genotypes 2, 3, 8 and 9 didn't fall in the same cluster as 1, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 16 and 17. Genotype 8 was the only one that did not classify with the rest of the Canadian genotypes. Also three European genotypes (2, 3 and 9) did not group with the others. In the second year genotypes 10 and 6 didn't fall in the major cluster. Of these genotypes 10 is of Canadian origin.

Performance of genotypes was more similar for seed yield in the second year than the first year since rainfall in second year was well distributed giving genotypes a better chance of expressing themselves. It was evident that genotypes from different geographical areas fell in the same clusters suggesting that they have genetic relatedness. Interestingly, genotypes from Europe fell in the same cluster as introductions from Canada. This was expected since rapeseed material has moved around the world into other breeding programs. The groupings indicated no correspondence between geographical diversity and clustering pattern.

Conclusion

All the European genotypes are Canola types (low in erucic acid and low in glucosinolates) and since Canadian breeders were the first to develop Canola types, most likely, European genotypes have canola genes incorporated through breeding. With this in mind selections have taken place on a narrow genetic base resulting in relatedness. From the evaluation trials, site specific recommendations have been made. In a study of this magnitude, genotype x environment interaction comes into play since the material is introduced into a new environment. So, to utilize these introductions in the Kenyan breeding program, accessions need to be subjected to molecular marker analysis to discriminate between them.

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REFERENCES

Mailer RJ, Wratten N, Vonarx M (1997). Genetic diversity among Australian canola cultivars determined by random amplified polymorphic DNA. Australian Journal of Experimental Agriculture. 37 (7): 793-800

Vetelainen M, Nissila E, Tigertedt PMA, von Bothmer R (1996). Utilization of exotic germplasm in Nodic barley breeding and its consequences for adaptation. Euphytica. 92 (1/2): 267-273.

Yau SK (1991). The need of scale transformation in cluster analysis of genotypes based on multi – locational yield data. J. Genet. And Breed. 45: 71-76.

Yau SK, Ortiz – Ferrara G (1994). Regression and Cluster Analysis of Elite Wheat lines grown in rainfed environment. J. of Genetics and Breeding 48: 183-190.

Yazdi – Samadi B, Mishani C A (1989). Cluster analysis in safflower. In Proceedings of Second International Safflower Conference, Hyderabad, India pp. 119-126