Adaptation of oilseed mustard under Kenyan conditions

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Abstract

Kenya has become increasingly dependent on imported edible oils yet many oilseed crops (e.g. sunflower, soybeans, rapeseed/mustard, sesame, groundnuts etc) can be grown. There is great potential for producing oilseed mustard as a cash crop and alternative crop since its very early maturing (80 days) and highly adaptable. Indian mustard offers promise for semi-arid areas where canola is not adapted. The early maturity makes them ideal break crops. The largest cereal producing districts in Kenya are experiencing excessive soil acidity, disease and pest problems due to continuous cropping. To alleviate this, a cheap and environmentally safe alternative crop has to be sought. During the 4 months fallow period after harvest, mustard can be seeded and ploughed in as green manure or harvested and sold to the processors. The objective of this study was to identify mustard cultivars that are adapted to new agroenviroments. Yield trials were planted in 2002 and 2003 at 3 locations (Njoro, Naivasha and Lanet) and comprised of 10 cultivars of oilseed mustards fitted in a completely randomized block design with 4 replicates. The seed rate was 10 kg/ha and DAP was mixed with the seed at 100 kg/ha during planting. Recommended agronomic practices were followed and data collected on various agronomic parameters but only the seed yield was subjected to analysis of variance (ANOVA). Genotypes were significantly different ($P \leq 0.05$) in Njoro and Lanet in 2002 and at all sites in 2003. However yields at Lanet were generally low compared to the other 2 sites. Five cultivars in Njoro (Kenmd 02, Kenmd 03, Kenmd 08, Kenmd 09, Kenmd 10) ranged between 1273 kg/ha and 1302 kg/ha. Kenmd 09 and Kenmd 10 yielded highest in Naivasha (1226 kg/ha) with the lowest yielder in Njoro (Kenmd 01) being outstanding in Naivasha (1389 kg/ha). Kenmd 02 and Kenmd10 were superior in Njoro while Kenmd 02, Kenmd 05 and Kenmd 08 out yielded the rest in Naivasha in 2003. Kenmd 02 appears to be widely adapted for it was consistently high yielding across sites and years. Hence oilseed mustard could be considered as a crop to plant on fallow in the major cereal producing areas when moisture recharge is limited.

Key words: Adaptation, break/exhaust crops, biofumigation, agroenviroments, Isothiocyanates, glucosinolates.

Introduction

With the widening edible oil deficit, Kenya has become increasingly dependent on imported edible oils. Many oilseed crops (e.g. sunflower, soybeans, rapeseed/mustard, sesame, groundnuts etc) can be grown in Kenya. There is great potential for producing oilseed mustard as a cash crop and alternative crop for Kenya since its very early maturing (80 days) and highly adaptable. Its early maturity makes it an ideal break crop.

For a crop to be well adapted it must be capable of exploiting both its physical and biological environments and be able to remain productive under pest and disease pressure (Hawtin, *et al*. 1996). The adaptation of a crop, its ability to survive in a particular environment and to exploit its various features productively is extremely complex and under genetic control. In formal systems, breeders are generally concerned with adaptation in one or three ways: 1) to develop cultivars which are better adapted to agro – environments in which the crop is currently produced 2) To develop cultivars better adapted to new agro - environments (geographic areas or farming systems), 3) To broaden adaptability in order to develop cultivars that are competitive over large areas and in the hope they will exhibit greater stability across seasons..

Indian mustard offers promise for semi-arid areas where Canola is not adapted. Its early maturity makes it an ideal break crop. The brassicas are known to control root disease by biofumigation (Angus, *et al.* 1999). This term is given to inhibition of pathogens by compounds released by root residues. Isothiocyanates (ITCs) are the major group of biologically active compounds that cause biofumigation. They are formed from the hydrolysis of glucosinolates (GSLs) when the plant is injured or matures. Root diseases are easily controlled when wheat is grown after a break crop such as oilseed brassica and the yield benefit to the following wheat crop makes an important contribution to the growth of the canola industry (Haines *et al*. 1996).

The largest wheat and maize producing districts in Kenya are experiencing excessive soil acidity, disease and pest problems due to continuous cropping. To alleviate this, a cheap and environmentally safe alternative has to be sought. During the 4 months fallow period after harvest, mustard can be seeded and ploughed in as green manure or harvested and sold to the processors.

Objective

To identify mustard cultivars adapted to new agroenviroments (geographic areas or farming systems).

Justifications

Mustards are early maturing (80-90 days) which makes them ideal break / relay crops.

Their deep rooting system and high water use efficiency give them an advantage over the other crops in the marginal rainfall areas. Mustards are more resistant to insect pests and diseases and possess an inherently higher yield potential than canola. They grow well in a variety of soils including those high in salinity and are more tolerant to shattering.

Materials and Method

This study was carried out in Njoro, Naivasha and Lanet for 2 years. The experimental design was a completely randomized block design with four replicates. Each plot consisted of 8 rows of was 3 x 2.7m long. DAP at 100 kg/ha was mixed with the seed at planting and seeded at 10 kg/ha. Pre-emergent herbicide (lasso EC) was applied to control the weeds. This was supplemented with manual weeding. Insect pests were controlled, as they appear using recommended insecticides. Data was collected on various agronomic parameters but analysis of variance (ANOVA) was carried out only on seed yield and means separated by LSD ($P \leq 0.05$).

Results and Discussion

Table 1 Mustard Yield at 3 locations in kg/ha, 2002

Line	Njoro	Naivasha	Lanet
Kenmd - 01	779.7c	1389.0	662.2b
Kenmd - 02	1302.1a	809.7	769.7ab
Kenmd - 03	1302.1a	948.6	759.8ab
Kenmd - 04	954.8abc	946.6	767.9ab
Kenmd - 05	1099.5abc	786.1	814.4a
Kenmd - 06	998.3abc	833.3	378.3c
Kenmd - 07	868.0bc	601.4	415.7c
Kenmd - 08	1273.1ab	879.2	700.0ab
Kenmd - 09	1302.1a	1226.4	669.3b
Kenmd - 10	1273.1ab	1226.4	674.4b
CV %	25.18	35.8	12.43
LSD ($\alpha = 0.05$)	352.1	-	95.40

Within each column, means followed by the same letter are not significantly different ($P \leq 0.05$)

Discussion

Cultivars were significantly different in Njoro and Lanet in 2002 (Table 1) however yields at Lanet were generally low compared to the other 2 sites. Five cultivars in Njoro (Kenmd – 02, Kenmd – 03, Kenmd – 08, Kenmd – 09, Kenmd – 10) ranged between 1273 kg/ha and 1302 kg/ha. Kenmd – 09 and Kenmd – 10 yielded highest in Naivasha (1226 kg/ha) with the lowest yielder in Njoro (Kenmd - 01) being outstanding in Naivasha (1389 kg/ha).

Insect pest damage was greatest when conditions were dry but these were effectively controlled. Due to availability of rain, the mustard lines were not pushed into early maturity and this contributed to the high yields realized in Njoro and Naivasha. Conditions in Lanet were drier than the other two sites.

Table. 2 Mustard Yield at 3 locations in 2003 (kgs/ha)

Line	Njoro	Naivasha	Lanet
Kenmd - 01	698.2abc	811.4c	648.2c
Kenmd - 02	985.1a	1012.6ab	654.6c
Kenmd - 03	702.7abc	893.6bc	795.9a
Kenmd - 04	681.2ab	931.7bc	722.5abc
Kenmd - 05	851.5a	994.3ab	688.0bc
Kenmd - 06	549.6cb	327.9d	368.5d
Kenmd - 07	418.9c	364.1d	378.4d
Kenmd - 08	860.5ab	1091.8a	651.5c
Kenmd - 09	722.7abc	901.8bc	737.7abc
Kenmd - 10	891.2a	816.5c	779.6ab
CV %	30.33	11.88	11.28
LSD ($\alpha = 0.05$)	267.18	112.31	84.16

Within each column, means followed by the same letter are not significantly different ($P \leq 0.05$)

The genotypes were significantly different ($P \leq 0.05$) in seed yields at all sites in 2003 (Table 2). Kenmd 02 and Kenmd10 were superior in Njoro while Kenmd 02, Kenmd 05 and Kenmd 08 out yielded the rest in Naivasha. Kenmd 02 appears to be widely adapted for it was consistently high yielding across sites and years. The high CV in Njoro was due to bird damage.

Conclusion

Mustards could form good break/exhaust crops in the predominantly cereal growing areas due to their early maturity. Yields are comparable to canola when moisture is not limiting. Considering the fact that oilseed mustard is tolerant to acid soils, there's need for more widespread testing. Based on this data, stability of the lines for either specific or broad recommendations can be determined. Genetic diversity studies should be initiated so as to identify germplasm for use in the breeding program. Bulking of breeders' seed should be enhanced.

References

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