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Research Application Summary

Evaluation of Chilli pepper genotypes for yield and reaction to field diseases

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Abstract

The performance of 25 chilli (16 exotic and 9 local) genotypes for yield and associated traits and reaction to field diseases was assessed at the National Crops Resources Research Institute (NaCRRI)- Namulonge from June-November, 2009. Total and marketable yields ranged from 1.9-9.9 t/ha and 0.9-7.6 t/ha, respectively. Genotype 28, 11, 4 and 14 gave the highest yields of 9.9, 9.1, 7.7 and 7.6 t/ha, respectively. The rest of the genotypes had yields ranging from 1.9 to 7.2 t/ha. Leaf spots and virus were the most prominent diseases. Some genotypes, especially 4, 12 and 22 appeared resistant to both *Coaenophora* and *Phytophthora* blights.

Key words: *Capsicum*, diseases, genotypes, yield performance

Résumé

Les performances de 25 génotypes à base de piment (16 caractères exotiques et 9 locaux) pour le rendement et associés à des maladies et la réaction sur le terrain a été évaluée à « L'Institut National de Recherche de Ressources des Cultures » (National Crops Resources Research Institut (NaCRRI) - Namulonge de Juin-Novembre 2009. Les rendements totaux et vendables variaient de 1,9 à 9.9 t / ha et de 0,9 à 7,6 t / ha, respectivement. Les Génotypes 28, 11, 4 et 14 ont donné les meilleurs rendements de 9,9, 9,1, 7,7 et 7,6 t / ha, respectivement. Le reste des génotypes avaient des rendements variant de 1,9 à 7,2 t / ha. Les taches foliaires et le virus ont été les maladies les plus éminents. Certains génotypes, en particulier, 4, 12 et 22 semblaient résistants à la fois aux maladies de *Coaenophor*a et des *Phytophthora*.

Mots clés: *Capsicum*, les maladies, les génotypes, la performance du rendement

Background

Hot pepper (*Capsicum annum* L.), has been adapted to diverse tropical farming environments for several centuries and has evolved into different plant and fruit types that adapt to area-specific cropping systems and utilization patterns. In Uganda, this crop is important as a spice and a vegetable and is majorly

produced for export providing both household income and foreign income to the country. Despite the importance of this crop to the people of Uganda and her economy, its production is constrained by poor quality of available cultivars and various field biotic stresses, among which diseases are the most prominent (IDEA, 2001; UEPB, 2005). Collection and mass screening of a diverse array of germplasm is necessary if cultivars with high yield, good horticultural traits and field disease resistance are to be identified. This study was carried out to evaluate and identify pepper genotypes with good horticultural traits, superior yield and field disease resistance for use in pepper cultivar improvement in Uganda.

Literature Summary

Hot pepper is one of the most varied and widely used food in the world (Terry and Boyhan, 2006) and ranks third among important vegetables after peas and tomato (Ali, 2006). However, the yields of this important crop are often low due to various biotic and abiotic stresses in their production environments (Black *et al*., 1991; DeWitt and Bosland, 1993; IDEA, 2001; UEBP, 2005). Even when optimal conditions are provided, the diversity in growth and development that exists among genotypes may further result in low yields.

Several fungal, bacterial, viral diseases, nematodes, mites and many insect pests are known to attack and cause significant losses in pepper (Black *et al*., 1991; Ochoa-Alejo and Ramirez-Malagon, 2001; Terry and Bohman, 2006) by causing extensive losses in the yield and quality of peppers (Black *et al.,* 1991; IDEA, 2001; UEPB, 2005). Diseasee severely reduce the production and profitability of this crop by reducing the period that the crop can be harvested. The major limiting diseases of most chilli peppers are phyto-pathogenic fungi, bacteria (Yoon, *et al.,* 1989; Black *et al*., 1991) and viruses (Black *et al*., 1991; Green and Kim, 1991). More than 35 viruses have been reported to infect peppers (Green and Kim, 1991). In Uganda, pepper is attacked by a vast number of bacterial, viral and fungal diseases (ADC, 2001; UEPB, 2005). However, most of these diseases apart from some viruses that have been reported (Sekyewa, 2007; Nono-Womdim, 2008, Mukasa, unpublished), have not been identified. Therefore, evaluation of a diverse germplasm for yield and reaction to field diseases is paramount so as to identify cultivars that yield highly and resist and/ or tolerate the major pepper diseases in Uganda.

Study Description

Field evaluation of 25 chilli genotypes was conducted under 'Alpha Lattice Design' for one season (June-November, 2009) with two replications to assess their performance for fruit yield and reaction to field diseases at Namulonge in Central Uganda. Fifteen AVRDC genotypes, one Chinese and nine local, including the local commercial variety as a check were evaluated. The spacing was maintained at 45 x 60 cm between plants and between rows respectively on raised single row plots. A population of 14 plants per plot was raised. Data were collected for various observed field diseases based on symptom expression, fruit yield and associated traits. The data were subjected to one way analysis of variance using Genstat (12th ed.) and means separated using Fisher's Protected LSD.

Research Application

Genotypes differed significantly ($P< 0.001$) for growth and yield traits (Table 1); for *Coaenophora* blight and leaf spots severity indices ($P<0.01$) and for *Phytophthora* blight and for viruses ($P < 0.005$) (Table 2). Average days to 50% fruit maturity ranged from 54-106 days, fruit length from 2.4-12.6 cm, fruit width from 0.8-2.1 cm, plant height from 10.8-39.3 cm, plant width from 10.6-48.8 cm, total fruit yield from 1.9-9.9 t/ha and total marketable fruit yield from 0.9-7.6 t/ha (Table 1).

Field disease severity indices also varied among the genotypes from (0.0-93.8) for *Coaenophora* blight, (6.7-79.8) for leaf spots, (0.0-44.2) for *Phytophthora* blight and (22.0-62.9) for viruses (Table 2). Varieties 25, 1, 20, 10 were the most susceptible to *Coaenophora* blight, leafspots, *Phytophthora* blight and viruses, respectively.

Genotypes 1, 18, 11, 14, all exotic, and 4 (local) showed superior yields compared to all varieties including the commercial check. Genotype 1 produced the largest fruit, 12.6cm long, 2.1cm wide and 16.2 g/fruit in weight. This genotype, however, was susceptible to leaf spots, viruses and *Phytophthora* blight.

From the study, genotypes that appeared to be resistant to *Coaenophora* blight and *Phytophthora* blight were identified. Genotypes 12, 10, 3 (local commercial variety) showed good resistance to all observed diseases but had low yields. Genotypes 12 and 18 were the best performers in terms of yield/ha. The identified superior genotypes over local cultivars should be evaluated for more seasons in more environments to validate the present findings.

Table 1. Means of growth and yield traits of Chilli genotypes evaluated from June – November, 2009 in Namulonge, Uganda.

VAR CODE	AFWT(g)	50% (DFM)	FRL (cm)	FWD (cm)	PHT(cm)	PWD (cm)	TFY (t/ha)	TMFY (t/ha)
1 (China)	16.2 m	83 efg	12.6 p	2.1 j	24.9 c-h	28.3 b-g	7.2 g-k	2.7 a-h
2 (Local)	1.9 ab	54 a	6.7 ef	0.8 ab	16.4 ab	20.4 abc	2.0 ab	0.9 a
3(commercial check)	1.7 ab	73 bcd	5.4 cd	0.9 a-c	31.7 h-k	38.7 g-k	4.7 a-h	3.1 c-h
4 (local)	3.5 def	74 cd	5.0 c	1.3 fg	34.4 kl	44.6 ijk	7.7 ijk	5.4 i
5 (Local)	2.3 bc	80 ef	3.7 b	1.3 fg	32.7 i-l	37.1 f-j	4.4 a-g	3.3 d-h
6 (Local)	1.2 a	70 bc	3.1 ab	0.9 ab	23.7 c-f	47.2 jk	1.9 a	1.4 abc
7 (Local)	2.0 abc	88 ghi	3.6 b	1.1 c-f	18.2 bc	33.1 d-h	2.2 ab	1.3 abc
8 (Local)	3.0 cde	69 bc	8.8 hij	0.9 a-c	26.2 e-i	30.6 c-g	4.9 b-i	3.6 fgh
9 (Local)	2.1 abc	89 hi	2.4 a	1.9 c-h	24.9 c-h	26.5 a-f	3.4 a-e	2.8 b-h
10 (Local)	2.4 bc	106 j	3.1 ab	1.7 hi	26.6 f-i	36.2 e-j	4.5 a-g	3.4 d-h
11(AVRDC)	6.1 ijk	68 b	9.5 jkl	1.3 fg	30.8 g-k	38.7 g-k	9.1 jk	4.4 hi
12(AVRDC)	1.8 ab	74 bcd	8.2 ghi	0.8 a	39.3 l	48.8 k	6.2 e-j	4.0 ghi
13(AVRDC)	3.8 ef	82 ef	7.7 fgh	1.2 d-g	26.9 f-j	30.6 c-g	4.8 a-i	2.6 a-h
14(AVRDC)	5.1 hi	71 bc	8.7 hij	1.4 g	27.6 f-k	33.7 e-i	7.6 h-k	3.5 e-h
15(AVRDC)	5.0 ghi	92 i	10.3klm	1.3 fg	10.8 a	18.4 ab	3.8 a-e	1.2 ab
16(AVRDC)	4.4 fgh	77 de	11.4mno	0.9 a-c	24.2 c-g	25.5 a-e	3.9 a-f	1.8 a-f
17(AVRDC)	4.2 fgh	73 bcd	11.5 nop	1.1 c-f	25.3 d-h	29.5 b-g	3.5 a-e	2.2 a-g
18(AVRDC)	6.4 jk	83 efg	9.0 ij	1.2 efg	34.5 kl	28.4 b-g	9.9 k	7.6 j
19(AVRDC)	5.6 ij	72 bcd	8.9 hij	1.3 fg	19.4 b-e	21.9 a-d	5.2 c-i	3.3 d-h
20(AVRDC)	3.7def	74 cd	9.1 ijk	1.0 b-d	19.1 bcd	16.6 a	3.1 a-d	1.6 a-d
21(AVRDC)	6.8 k	83 fgh	10.5 l-n	1.2 d-g	33.7 jkl	43.7 h-k	6.8 f-j	2.5 a-g
22(AVRDC)	11.5 l	85 fgh	12.4 op	1.6 h	24.4 c-g	30.9	5.6 d-i	1.7 a-d
23(AVRDC)	2.7 bcd	72 bcd	6.3 de	1.0 a-c	24.3 c-g	29.6 c-g	4.1 a-f	2.7 a-h
24(AVRDC)	2.4 bc	74 bcd	7.2 efg	1.0 b-e	25.5 d-h	31.0 c-g	4.0 a-f	2.2 a-g
25(AVRDC)	4.0 efg	69 bc	7.7 fgh	1.0 b-e	14.6 ab	20.3 abc	2.6 abc	1.7 a-e
Range	1.2-16.2	54-106	2.4-12.6	0.8-2.1	10.8-39.3	10.6-48.8	1.9-9.9	0.9-7.6
Mean	4.4	77	7.7	1.2	25.6	31.6	4.9	2.8
SED	0.494	2.685	0.56	0.11	13	5.407	1.41	0.9
LSD (5%)	1.02	5.541	1.17	0.22	6.863	11.16	2.91	1.8
F-test	***	***	***	***	***	***	***	***
CV (%)	11.3	3.5	7.3	8.9	3.325	17.1	28.7	31

*** highly significant ($P < 0.001$). Means within columns followed by same letter are not significantly different at 5% level according to FPLSD; AFWT = Average fruit weight, DFM = Days to 50% fruit maturity, FRL = Fruit length, FRW = Fruit width, PHT = Plant height, PWD = Plant width.

Table 2. Means of disease severity index (DSI) of observed field diseases.

VAR NAME	COSI	LSSI	PHSI	VISI
1 (China)	1.0 (0.0) g	9.0 (79.8) a	4.5 (32.1) a-d	6.5 (42.5) a-g
2 (Local)	1.5 (1.5) fg	5.2 (26.5) e-j	6.3 (39.8) ab	7.4 (54.1) ab
3(commercial check)	2.6 (8.5) efg	5.6 (30.7) d-i	3.9 (14.1) a-f	5.2 (27.0) d-g
4 (local)	1.0 (0.0) g	3.8 (15.9) h-k	1.0 (0.0) f	7.2 (51.2) abc
5 (Local)	3.1 (8.8) efg	4.8 (21.9) f-k	1.0 (0.0) f	7.4 (54.2) ab
6 (Local)	7.3 (53.0) abc	8.3 (68.4) abc	1.0 (0.0) f	7.2 (51.2) abc
7 (Local)	9.3 (85.1) a	8.2 (67.5) abc	1.0 (0.0) f	7.0 (48.6) a-d
8 (Local)	3.5 (17.9) d-g	5.3 (28.2) e-j	4.5 (20.0) a-d	7.4 (53.5) abc
9 (Local)	1.8 (2.9) fg	6.3 (39.0) b-g	1.0 (0.0) f	5.5 (28.8) c-g
10 (Local)	3.8 (15.4) def	3.1 (8.6) jk	3.0 (7.7) c-e	8.0 (62.9) a
11(AVRDC)	2.5 (7.9) efg	4.3 (17.5) g-k	3.0 (7.9) c-f	7.3 (52.1) abc
12(AVRDC)	1.0 (0.0)g	2.7 (6.7) k	1.0 (0.0) f	4.8 (22.0) fg
13(AVRDC)	6.0 (35.3) bcd	5.8 (33.3) d-i	2.2 (5.0) def	7.3 (51.7) abc
14(AVRDC)	1.0 (0.0) g	3.4 (11.7) ijk	1.0 (0.0) f	4.8 (23.0) efg
15(AVRDC)	9.2 (84.2) a	7.8 (60.2) a-d	4.0 (18.4) a-e	6.8 (45.4) a-e
16(AVRDC)	2.8 (10.0)efg	5.9 (35.0) c-h	3.5 (17.8) b-f	6.7 (44.6) a-f
17(AVRDC)	8.9 (79.3) a	8.7 (75.0) ab	5.9 (36.6) abc	4.8 (23.1) fg
18(AVRDC)	1.0 (0.0) g	7.7 (58.9) a-d	1.0 (0.0) f	6.3 (39.0) a-g
19(AVRDC)	5.1 (25.3) cde	6.1 (36.6)	1.1 (1.4) ef	6.6 (43.2) a-g
20(AVRDC)	8.0 (65.4) ab	7.3 (55.0) a-e	6.6 (44.2) a	5.9 (37.7) b-g
21(AVRDC)	1.7 (2.1) fg	6.0 (34.5) c-h	1.0 (0.0) f	7.4 (55.1) ab
22(AVRDC)	1.0 (0.0) g	5.8 (33.0) d-i	1.0 (0.0) f	4.7 (22.0) g
23(AVRDC)	1.0 (0.0) g	7.5 (57.3) a-e	1.1 (1.4) ef	6.9 (46.4) a-d
24(AVRDC)	1.0 (0.0) g	5.1 (25.5) e-j	1.0 (0.0) f	5.7 (31.7) b-g
25(AVRDC)	9.7 (93.8) a	6.7 (46.9) a-f	1.0 (0.0) f	5.8 (33.0) b-g
Range	1.0-9.7(0.0-93.8)	2.7-9.0(6.7-79.8)	1.0-6.6(0.0-44.2)	4.7-8.0 (22.0-62.9)
Mean	3.8 (23.9)	6.0 (38.9)	2.5 (9.8)	6.4 (41.8)
SED	1.348	1.163	1.43	0.952
LSD (5%)	2.782	2.4	2.95	1.965

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