Cultivar Evaluation for Red Pepper under Organic Crop Management in Korea

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Key words: disease resistance, evaluation, organic management, red pepper cultivar, yield.

Abstract

To screen several promising red pepper cultivars, may be adaptable to organic cultivation conditions, seventy six F1 hybrids commercial and eight local purebred red pepper cultivars were tested. Comparing the infection rate of phytophthora blight between commercial (F1 hybrid) and local (Purebred) cultivars, average infection rate of commercial cultivars was 9.8% and that of local cultivars was 17.8%. But the infected fruits rate of anthracnose in field were similar as 3.3% in commercial (F1 hybrid) and 3.1% in local (Purebred) cultivars. In yield characteristics, average yield of commercial cultivars was 2.89 t ha^{-1} and that of local cultivars was 2.22 t ha^{-1}. For organic pepper farmers it is more favourable to cultivation purebred cultivars because they can save to the same quality plant next year's crop. In this study among the local purebred cultivars, two cultivars are promising that their yield near to 3 t ha^{-1} and have disease field resistance.

Introduction

Red hot pepper is one of the most important vegetable crops for seasoning foods in Korea. The need for sustainability of performance in pepper was increased, particularly in organic agriculture in Korea. But it is limited by the lack of varieties adapted to organic conditions (Wolfe *et al.* 2008). In future, the requirement for organically cultivated vegetable will be increasing steadily; therefore many organic growers are searching for certified organic seed and adaptable cultivars for organic environments. In America, smaller seed companies have produced the majority of organically produced seed to date (Bonina *et al.* 2004). Lammerts Van Bueren *et al.* (2002) already suggested the general variety characteristics on the basis of the agro-ecological approach to enhance the self-regulating ability for the main components of organic farming strategies. The general criteria for variety characteristics are adaptation to organic soil fertility management, weed suppressiveness, crop health, seed health and yield and yield stability.

Therefore, in the present study we tried to screen several promising red pepper cultivars, which may be adaptable to organic cultivation conditions. Especially resistant to most problem diseases like pepper anthracnose and blight, and have high yield capacity in organic cultivation.

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Materials and methods

Eighty four red pepper cultivars were tested to select for organic cultivation (Table 1). Sixty F1 hybrid commercial cultivars are resistant to blight disease, sixteen F1 hybrid commercial cultivars are medium resistant to phytophthora blight disease and eight local purebred cultivars are medium resistant to blight disease. For this study, the green manure crops were fall-seeded in last year and before transplanting compost of 10 ton per ha was applied. On May 10, eighty four kinds of seedlings were transplanted in 100 cm rows. The red peppers were harvested three times and the capsaicin contents were analyzed.

For selecting disease resistant cultivars, the inoculation was conducted in laboratory. In phytophthora blight resistance test, each cultivar was inoculated with 5ml suspension by dispenser at concentration of $1x\ 10^3$ and $1x\ 10^5$ zoospore/ml on sixty-day old pepper seedlings in pot. After inoculation, it was investigated three times at every 7 days (Fig ure1). In anthracnose resistance test, the inoculation was divided into green and red pepper fruits. Inoculation was conducted on three parts (top, middle, tail) of pepper fruit with concentration of $2\ x\ 10^6$ conidia/ml by pinning as a wound-inoculation method. Ten days after inoculation, the lesion area was measured as diameter (Figure 1). These inoculation results of anthracnose were compared to infected fruits rate in field (Figure 2).

Tab. 1: Sources of evaluated cultivars in present study

Item	Resistance to blight*	Fixation	Number
Commercial cultivar	R	F1 hybrid	60
	M	F1 hybrid	16
Local cultivar	M	Purebred	8

* R: resistant to blight disease, M: medium resistant to blight disease

Results

Figure 1 shows the frequency distributions of the most troublesome diseases on peppers. In this year, it was difficult to select resistant cultivars in field because the whether is somewhat better that the phytophthora blight disease did not occur severely. In laboratory Inoculation, 83.4% of cultivars were less than 20% infection, 14.4% of cultivars were between 30~50% infection and 2.4% of cultivars were more than 60% infection. For the infection fruits of anthracnose in field, 78.6% of cultivars were infected less than 5%, 12% of cultivars were infected 6~10% and 8.4% of cultivars were infected more than 10%. Comparing the infection rate of phytophthora blight between commercial (F1 hybrid) and local (Purebred) cultivars, average infection rate of commercial cultivars was 9.8% and that of local cultivars was 17.8%. But the infected fruits rate of anthracnose in field were similar as 3.3% in commercial (F1 hybrid) and 3.1% in local (Purebred) cultivars.

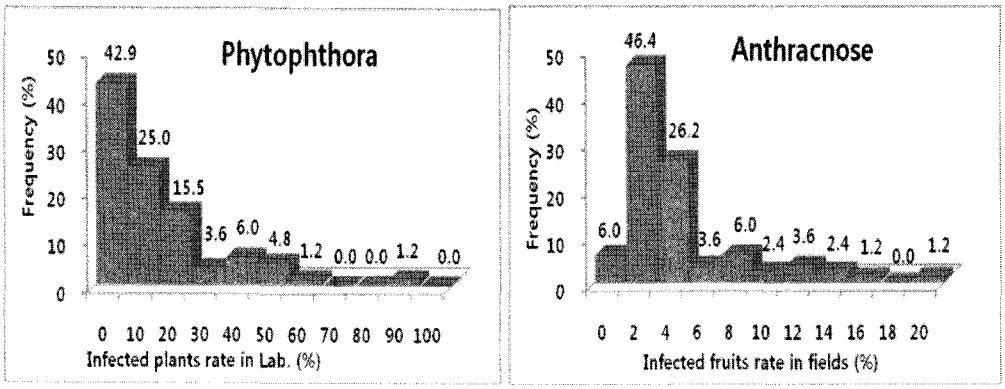

Figure 1: Frequency distribution of inoculated pepper plants rate of phytophthora blight in laboratory and infected fruits rate of anthracnose in field (n=84). Inoculation concentration of blight was 1 x 10^5 zoospores ml^{-1} in laboratory.

Figure 2 shows the relationship between infected lesion size of pepper fruit by inoculation in laboratory and naturally infected fruits rate by anthracnose in field. Between inoculation of green and red fruits, the correlation coefficient of green pepper was higher and signicant than that of red fruits, suggesting easier infection on the green pepper fruit than red one.

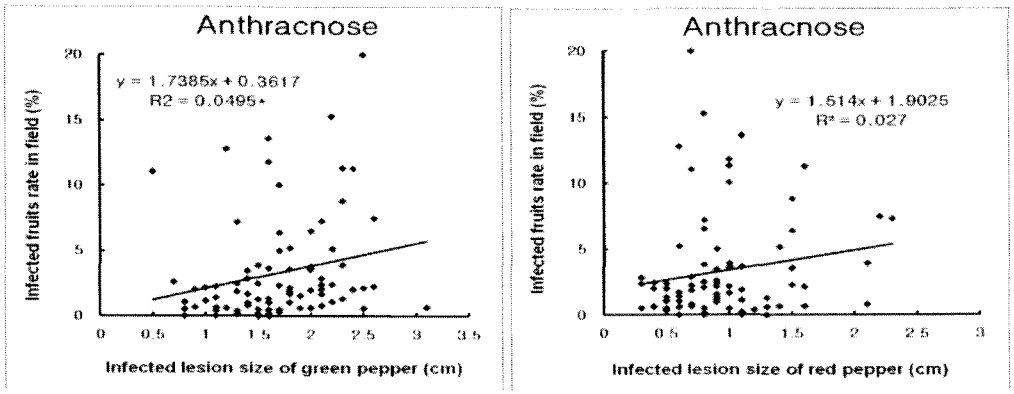

Figure 2: The relationship between infected anthracnose lesion size of pepper fruits and infected fruits rate in the fields (n=84). Inoculation concentration of anthracnose was 2 x 10^6 conidia ml^{-1} in laboratory.

Figure 3 shows the frequency distribution of dried red pepper yield (t ha^{-1}) and capsaicin contents. For the yield distribution, 10.7% of cultivars were 2 t ha^{-1}, 89.2% of cultivars were 2.5~3.5 t ha^{-1} and 9.6% of cultivars were more than 4 t ha^{-1}. For the capsaicin contents distribution, 78.7% of cultivars were less than 60 mg g^{-1}, 16.7% of cultivars were 80~120 mg g^{-1} and 4.8% of cultivars were more than 140 mg g^{-1}. Comparing the yield between commercial (F1 hybrid) and local (Purebred) cultivars, average yield of commercial cultivars was 2.89 t ha^{-1} and that of local cultivars was 2.22 t ha^{-1}.

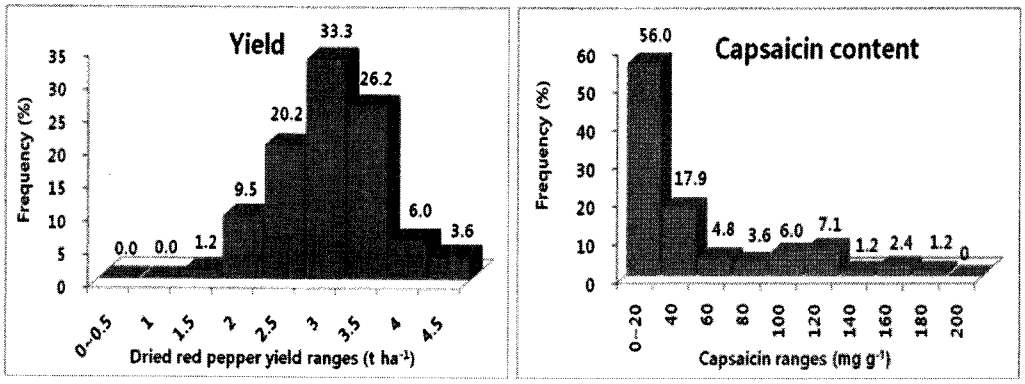

Figure 3: Frequency distribution of dried red pepper yield (t ha^{-1}) and capsaicin contents (mg g^{-1}) (n=84).

Discussion

On principle, organic pepper farmers have to use organically produced seeds and planting materials. However actually the organic pepper seeds are limited and it is difficult to obtain, because almost commercial seeds are treated post harvest with chemical-synthetic fungicide or pesticide. To obtain good seeds, it is needed to select better cultivars adapted to organic farming systems. Many organic farmers want to grow hybrid cultivars, because the seeds must be the offspring of two parents that differ in one or more heritable characteristics and have heterosis. In present study, the yield of F1 hybrid commercial cultivars is higher than that of purebred cultivars, and general resistance to disease of commercial cultivars are also stronger. However, the seeds collected from a grown hybrid commercial cultivars will not be true to type when replanted and thus cannot be saved to plant next year's crop (Kirschenbaum 2000). Thus it is necessary to introduce the disease resistant gene to the local pepper cultivars which are genetically fixed purebred. In Korea, because of severe anthracnose disease outbreak after summer season, early maturing cultivars which can avoid that season also adaptable to organic crop management. In this study among the local purebred cultivars, two cultivars are promising that their yield near to 3 t ha^{-1} and have disease field resistance.

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