Fruit Yield and Quality Evaluation of Sweet Pepper (Capsicum annuum L.)
F1 Hybrids Derived from Inbred Lines

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Abstract: Sweet pepper inbred lines (KNU1003, KNU1006, KNU1007, KNU1009, KNU1015, KNU1017 and KNU2006) developed at Kangwon National University (KNU) through conventional means, inbred lines (5AVS1, 5AVS2, 5AVS3, 5AVS5, 5AVS7 and 5AVS8) collected at Rural Development Administration (RDA) and inbred lines (SP12, SP27 and SP14) derived from anther culture were used as female parents and anther culture derived homozygous lines (SP9, SP10, SP14, SP24, SP25, SP27, SP30, SP32, SP34, SP38, SP43, SP45 and SP51) were used as male parents to produce F1 hybrids. A total of 37 F1 hybrids were evaluated for fruit yield and quality characters in summer season, 2007. Variation in fruit number, fruit weight, fruit yield per plant and fruit volume was observed among the F1 hybrids. Superiority on yield over standard/commercial varieties were differed among F1 hybrids. Hybrid 5AVS8 x SP45 exhibited highest heterosis over Special (16.5%) and Fiesta (24.7%). Fruit quality characters (fruit length, fruit width, pericarp thickness, total soluble solid, fruit shape and fruit color) were varied among the F1 hybrids. Fruit number, fruit weight and fruit volume per plant were correlated with fruit yield. Based on the standard heterosis expressed by the hybrids and quality characters evaluation, KNU1017 x SP27, 5AVS1 x SP43, 5AVS5 x SP27, 5AVS8 x SP45, SP12 x SP38 and SP27 x SP25 hybrids were found to be superior over commercial cultivars and are selected. Inbred lines of these hybrid combinations can be used to produce F1 hybrid seed for commercial production.

Key words: inbred lines, anther culture, standard heterosis, total soluble solid, correlation

INTRODUCTION

Sweet pepper (Capsicum annuum L.) is the most important vegetable crop in the world. In Korea, it is a fast emerging income-generating vegetable. In Korea, sweet peppers are cultivated in 367 ha with total production amount of 32,778 t (MFAFF, 2008). Sweet peppers have enormous potentiality for export market to neighboring countries like Japan and China. Though it has the great demand in the domestic and international market, its production in Korea cannot meet the galloping demands and currently cultivated varieties cannot fulfill the demands. Therefore, there is urgent need to develop the high yielding sweet pepper varieties to meet the market demand.

Cultivated varieties in Kangwon-Do Province are exotic hybrids and mostly imported from Netherlands. Sweet pepper has been cultivating under protected green house. Nonetheless, the yield of hybrids is lower as compared to European and American countries (Shrestha, 2009). Hence, it is imperative to develop the new varieties with good quality through rapid and advance breeding methods.

Inbred lines can be developed either from a conventional method of breeding or anther culture. Inbred lines are used to develop populations of single crosses, three-way crosses, double crosses, backcrosses and complex crosses (Greenleaf, 1986). Heterosis describes increased size and yield in crossbred as compared to corresponding inbred lines (Shull, 1948). Maximum heterosis is observed in the F1 (Meyer et al., 2004). Standard heterosis is defined as the heterosis over the standard varieties. Evaluation of F1 hybrid and selection of better hybrid combination over the current commercial cultivar will achieve the better economic return to farmers from heterosis breeding.

Studies on development of inbred lines through anther culture or from successive self-pollinations to make F1 hybrids
have not been reported in Korea. Therefore, this study was aimed to evaluate F1 hybrids derived from inbred lines to supply the superior hybrids for commercial production.

**MATERIALS AND METHODS**

**F1 seed production**

Inbred lines developed at KNU from self-pollination, collected at Rural Development Administration (RDA) and anther-culture derived homozygous lines were used to produce F1 seed. KNU developed inbred lines (KNU1003, KNU1006, KNU1007, KNU1009, KNU1015, KNU1017 and KNU2006), RDA inbred lines (5AVS1, 5AVS2, 5AVS3, 5AVS5, 5AVS7 and 5AVS8), anther-derived homozygous lines (SP12, SP27 and SP14) were used as female parents and anther derived homozygous lines (SP9, SP10, SP14, SP24, SP25, SP27, SP30, SP32, SP34, SP38, SP43, SP45 and SP51) were used as male parents and pollination was accomplished under nylon netted plastic house in 2006 at Hwacheon. Before pollination, flowers were hand-emasculated and pollen of desired male parent transferred to the stigma of female parents by touching a freshly dehisced anther. General principles (Allard 1999; Singh 1999) and techniques (Singh, 2002) were followed during hybridization. Pollinated flowers were marked by colored thread with tag and allowed to fruit until maturation and resulted 37 F1 seeds were harvested for further evaluation in following year.

**F1 hybrid evaluation**

Seeds of 37 hybrid combinations obtained from artificial crosses between parental inbred lines in previous years and seed of popular hybrid cvs. Special and Fiesta (commercial checks) were planted in plastic plug tray to produce the transplants and subsequent to evaluate its fruit yield and quality characters. Twenty seedlings of each F1s were transplanted on bed, which was mulched with black polythene under plastic greenhouse condition in summer season of 2007. Inter-row distance of 0.5 m and plant to plant distance of 0.4 m as well as a path of 1 m between the plots were maintained for all the experimental units and all progenies were transplanted at non-replicated/row design. Fertilizer solution (1-1.5 mg/l) was supplied through drip irrigation system. Plants received the periodic fertilization and irrigation and cultural practices were followed as per Rural Development Administration (RDA) recommendation on sweet pepper cultivation.

Number of fruits beared in plant was counted from the rows on 10 plants by excluding single border plant on each side of the row until to be mature and then it was averaged. At least 10 ripened fruits from each hybrid were harvested at a time and observation on fruit yield, yield attributes (fruit no., fruit weight (g), fruit volume (cc) and fruit weight (g)) and quality characters including fruit length (cm), fruit width (cm), pericarp thickness (mm), total soluble solid (°Brix), fruit shape and fruit color were recorded. Fruit weight per fruit was measured by digital balance; fruit yield per plant was determined by adding weight of all the fruits harvested from each plant. Fruit volume was measured by volume of water displaced by the fruit; fruit length (cm) was measured by vernier caliper from the pedicel attachment to its apex. Fruit width (cm) was measured at the basal portion of the fruits. Pericarp thickness was measured by vernier caliper and TSS °Brix was determined by hand-held refractrometer. Fruit shape was recorded on 1-9 scale of paprika (1=heart, 2-3=blocky, 4=lamuyo or glamour, 5=cone, 6=square, 7=rectangular, 8=triangular and 9=cylindrical) and fruit color was assessed on visual basis. Standard heterosis was calculated by \((F1-SV)/SV*100\) where SV=Standard value of commercial/standard check varieties. Simple correlation coefficient was worked out among the yield and quality traits using values (n=39). Mean values of the each trait and their standard deviation at F1 progenies, and standard varieties were analyzed.

**RESULTS AND DISCUSSION**

**Fruit yield attributes, yield and standard heterosis**

Results of fruit yield parameters and standard heterosis on yield over commercial varieties are presented in Table 1.