

## Studies on Genetic Variability of Pear Germplasm

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The pomological evaluation of 23 pear cultivars showed marked variation for all the morphological, fruit and quality parameter studied. The mean plant height ranged from 3.5 to 9.7 meters, tree girth 38 to 112 cm and plant spread from 3.0x3.2 to 6.8x6.2 meters. The cultivars expressed wide genetic variation. Cultivar Awal Number was early to attain full bloom on 22<sup>nd</sup> March whereas Bode Capiament was late and full bloom was recorded on 23<sup>rd</sup> April. Cultivars Kala Hathi, Kashmiri Pear, Max Red Bartlett and Beurre Hardy were more productive in comparison to Novem Poitrum, Hengal, Seckel Yakumo, etc. Red Bartlett and Max Red Bartlett had better fruit weight (180.6 and 150 g) and size (78.3x75.2 mm and 73.5 x 68.4 mm); Basuiodse Favorite highest TSS (18.7°Brix) Anjou. Kashmiri Pear and Flemish Beauty were higher in fruit firmness.

**Key words:** Pear, Genetic variability, Germplasm, Selection, Trait, Adaptability

Pear (*Pyrus communis*) is considered to be the most popular and important temperate fruit after apple. It is a prehistoric crop and its cultivation in Europe started at an early time compared to that of apple. *Pyrus* genetically is diverse and its gene pool is very well defined. Speciation through geographic isolation by mountain ranges and its adaptation to colder and drier areas provided man with variability from which to select desirable ones. The European pears for their soft buttery texture, distinct flavour, and with wide genetic variation both at species and variety level is regarded as the most delectable of all temperate fruits. Apple and pear though introduced almost at the same time in India, pear cultivation is far behind compared to that of apple, main reason being few cultivars introduced failed to adapt to varied agro-climatic conditions of Himachal Pradesh, low storage and transportation potential, non availability of suitable rootstocks, etc.

However, today marked changes in the germplasm have been brought about through introduction of diverse types varying in chill requirement, wide adaptability, colour, taste, storage and number of other characters. Temperate Horticultural Research Station, Kotkhai has been a centre for introduction and testing of pome and stone fruit. With the rapid changes in climatic conditions both apple production and productivity is sharply receding. To sustain this trend, production needs to be increased through diversification, and by way of cultivating other suitable crops. In this regard, pear is the most suitable alternative. With this in view, pear cultivars grown at the station were evaluated for various growth, yield and quality characters.

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### Materials and Methods

The evaluation work on pear was undertaken at the experimental farm of Temperate Horticulture Research Station, Kotkhai during the year 2004 and 2005. The experimental material comprised 23 pear germplasm, which were introduced from different countries and through NBPGR Shimla. The cultivars were planted on seedling rootstock and each cultivar was replicated three times in a randomized block design. The data on characters like plant growth yield, physico-chemical traits of different cultivars was evaluated for two years of study i.e. 2004 and 2005 as per the standard methods. The data on various parameters was analyzed as per the method of Panse and Sukhatme (1985).

### Results and Discussion

The tree growth characteristics recorded in terms of tree height, girth and spread of 23 pear cultivars is indicated in Table 1. The data shows marked inherent variation for tree height, which ranged from 3.5 to 9.7 meters. Minimum tree height was observed in cultivars Kiskusui and Luhimtra Kalapa (each 3.5 m) followed by Manning Elizabeth (4.5 m). Bodde Capiament (4.6 m). All these cultivars were statistically similar to each other. Cultivar Kalahathi was the tallest growing (9.7 m), followed by Autumn of Yaklex (8.5 m) and Ishiwase (8.2 m). None of these cultivars differed for tree height character and were similar statistically. The other cultivar also depicted genetic variation amongst themselves.

The character tree girth also revealed variation (3.8 to 112 cms). Cultivar Beurre Hardy had the maximum tree girth (112.0 cm), followed by Ishiwase (109.0 cm) and Autumn of Yaklex (91.0 cm) except for the last

cultivar. The other two were at par with each other. On the other hand, cultivars Manning Elizabeth had least tree girth (38.0 cm) followed by Luhimtsa Kalapa (44.0 cm) and William Bon Chretien (53.0 cm). All the three cultivars were statistically non-significant. Plant spread recorded in two directions, i.e. East-West and North-South also showed variation. Cultivar Kiskusui had least plant spread (2.5x2.3 m) followed by Luhimtsa Kalapa (3.0x3.2 m) and Bodde Capiament (3.8x4.2 m) and all were similar statistically, whereas cv. Ishiwase had maximum spread (6.8x6.2 m) followed by Kalahathi (6.3x6.2 m) and Basuiodsc favourite (6.5x6 cm). Statistically these cultivars, were similar. The (lowering period of evaluated cultivars spread over to 33 days. Cultivar Awal Number was first to flower (22<sup>nd</sup> March), Flemish Beauty (30<sup>th</sup> March). The other cultivar, late to attain full bloom were Bode Capiament (23<sup>rd</sup> April), Kiskusui and Lisnova Karavista (20<sup>th</sup> April) and Red Bartlett (19<sup>th</sup> April). The yield and fruit quality characters of various cultivars evaluated is presented in Table 2. The yield per tree varied from 5.0 to 90.0 kg. Cultivars Seckel (5.0 kg), Noveum Poitrum (7.0 kg), Kiskusui (12.0 kg), Yakumo (12.50 kg), Hengal (15.0 kg), were all low crop producing cultivars. All these cultivars were statistically similar to each other. The higher crop producing cultivars were Kalahathi (90.0 kg), Kashmiri Pear (77.0 kg) and Beurre Hardy (60.0 kg). The first two cultivars were statistically similar but differed from Beurre Hardy. The intermediate cultivars from yield point of view were Max Red Bartlett (63.0 kg), Starkrimson (42.0 kg), Bartlett (45.0 kg), whereby showing varietal variation in crop production.

The fruit size also showed substantial variation. Cultivar Yakumo had the most small sized fruits (41.3x45.0 mm), followed by Early China (44.2x47.4 mm) and Awal Number (45.0x53.3 mm), whereas Manning Elizabeth (67.3x65.0 mm), Williams Bon Chretien (66.0x65.0 mm) and Luhimtsa Kalapa (64.3x54.3 mm) recorded higher first size values, the cultivar with higher and lowers values were at par with each other. Fruit size ranged from 47.5 to 186.6 g per fruit. Higher fruit weight was observed in cultivars Red Bartlett (186.6g), William Bon Chretien (150.0 g) which differed statistically followed by Autumn of Yaklex (140.0 g), Starkrimson (126.2 g), Kashmiri Pear (110.0 g) Ishiwase and Lisnova Karavitsa (1 16.6 g).

The total soluble solid (TSS) contents of assessed cultivars was variable and ranged form 10.0 to 18.7°Brix. Cultivars Noveum Poitrum (10.0). Bode Capiament,

Table I. Growth character of different pear cultivar (2004 and 2005)

Cultivar	Tree height (m)	Tree girth (cm)	Tree spread (m)	
			NS	EW
Ishiwase	8.2	109	6.8	6.2'
Kiskusui	3.5	46	2.5	2.3
Yakumo	5.8	59	5.2	4.9
Seckel	6.2	86	5.4	5.0
Anjou	6.5	94	4.0	4.7
Beurre Hardy	7.2	112	5.4	4.8
William Bon Chretien	4.7	53	4.8	5.3
Lisnova Karasvitsa	6.0	79	5.0	5.1
Luhimtsa Kalapa	3.5	44	3.0	3.2
Jargo nelle	7.2	75	5.8	5.2
Kala Hathi	9.7	81	6.3	6.2
Autumn of Yaklex	8.5	91	5.8	6.2
Kashmir Pear	7.4	85	5.5	4.8
Manning Elizabeth	4.5	38	4.0	4.5
Hengal	6.0	63	5.9	6.1
Bodde Capiament	4.6	82	3.8	4.2
Flemish Beauty	5.2	78	4.7	4.7
Noveum Poitrum	6.4	80	5.2	5.3
Awal Number	7.2	86	5.8	5.3
Basuiodsc Favourite	7.5	82	6.5	6.0
Red Bartlett	5.3	62	5.2	4.4
Max Red Bartlett	5.4	56	4.5	4.4
Starkrimson	4.9	59	4.3	4.6
CD <sub>0.05</sub>	2.87	19.70	17.8	1.86

Yakumo (11.0), Kiskusui and Seckel (12.0) and William Bon Chretien (115.0 Brix) were similar for TSS contents whereas cvs. Basuiodsc Favourite (18.7), Early China (17.2), Max Red Bartlett (15.4) and Red Bartlett (14.8° Brix) had higher TSS contents. On the basis of TSS specific groups of cultivars can be established. The fruit firmness differed among the cultivars. Cultivar Kalahathi had least firmness (1.5), followed by Autumn of Yaklex. Basuiodsc Favourite and Starkrimson all had firmness of 17.0 lb/inch<sup>2</sup> and the cultivars were statistically similar compared to Flemish Beauty and Anjou (20.0), Hengal (19.5) and Red Bartlett (19.2), Seckel, Kiskusui and Manning Elizabeth (19.0 lb/inch<sup>2</sup>), which recorded higher firmness.

Appropriate selection of diverse genotypes is the foundation of a successful orcharding system. Hence prior to recommendation of any genotype for cultivation at a particular place or region the germplasm needs to be systematically evaluated for different horticultural traits. Number of workers have evaluated pear germplasm in different parts of world and have recommended few which have performed exceptionally well over long period of time (Bernkoff, 1990; Bell, 1990; Coa Zong Fu, 1999; Blanchet *et al.*, 1997; Sharma and Sharma, 2002; Rachna, 2003; Bist and Yadav, 2004).

Table 2. Yield and fruit quality of pear cultivars (2004 &amp; 2005)

Cultivar	Yield kg/tree	Fruit size		Fruit weight	TSS (°Brix)	Fruit firmness lb/inch <sup>2</sup>	Date of full bloom 04-05
		Length (mm)	Breadth (mm)				
Ishiwase	30.0	46.3	56.6	116.5	14.5	20.0	12-14/04
Kiskusui	12.0	37.3	40.3	50.0	12.0	19.0	20-23/04
Yakumo	12.5	41.3	45.0	63.3	11.0	18.0	8-10/04
Seckel	5.0	53.6	54.6	116.6	12.0	19.0	17-19/04
Anjou	30.0	52.3	56.6	100.0	12.5	20.0	7-9/04
Beurre Hardy	60.0	56.6	54.3	106.6	10.5	18.0	6-9/04
William Bon Chretien	5.5	66.0	60.0	150.0	11.5	18.5	11-14/04
Lisnova KLaravitsa	24.5	57.6	52.6	116.6	14.5	19.2	20-24/04
Luhimtsa Kalapa	25.0	64.3	54.3	103.0	13.5	17.0	18-21/04
Jargo nolle	32.5	50.6	45.0	70.0	12.5	18.0	12-15/04
Kala Hathi	90.0	58.3	47.3	76.6	13.5	16.5	12-16/04
Autumn of Yaklex	20.0	40.6	63.3	140.0	13.0	17.0	13-16/04
Kashmir Pear	77.0	54.0	54.3	110.0	14.0	20.0	31-34/04
Manning Elizabeth	35.0	67.3	65.0	186.6	14.5	19.0	5-8/04
Hengal	15.0	53.3	51.6	83.3	12.5	19.5	26-31/04
Bodde Capiament	30.0	55.6	45.6	80.0	11.0	18.0	23-27/04
Flemish Beauty	25.0	52.0	54.3	136.6	13.0	20.0	30-34/04
Noxeum Poitrum	7.0	40.3	52.6	100.0	10.0	18.5	15-18/04
Awal Number	30.0	45.0	53.3	100.0	14.0	17.5	22-27/04
Basuiodsc Favourite	25.0	48.5	43.5	56.6	18.7	17.0	1-4/04
Red Bartlett	45.0	78.3	75.2	186.6	14.8	19.2	19-22/04
Max Red Bartlett	63.0	73.5	68.4	150.0	15.4	18.4	3-6/04
Starkrimson	42.0	64.0	58.0	126.2	14.6	17.7	7-9/04
CD <sub>0.05</sub>	12.46	8.32	8.63	13.6	2.24	1.23	

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