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Original Research Article

Evaluation of Acid Lime Clones for Growth Yield and Quality

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A B S T R A C T

A survey conducted for selection of better type of acid lime for yield as well as quality at AICRP (Fruits), Dr.PDKV, Akola. Followed by initial *in-situ* evaluation, total ten elite clones were selected and finally five most superior clones were evaluated along with commercially popular varieties viz. PDKV lime and Sai Sarbati as check including another seedless new release PDKV Chakradhar in RBD replicated thrice for comparison. Five years study indicated. PDKV Bahar (Clone-2) was superior over other clones as well as check varieties and recorded significantly maximum yield (124.92 kg/plant i.e.34.54 t/ha),no of fruits(1833/plant),TSS(8.39^{0}B) and acidity(7.18%).In other quality parameter PDKV Bahar (average fruit wt 54.31g,juice 52.41% and ascorbic acid 31.47 mg) stood next to the PDKV lime(average fruit wt 55.73g, juice 53.04% and ascorbic acid 31.57 mg). PDKV Bahar reported 14.71 and 21.32 % increase in yield over the PDKV lime and Sai Sarbati respectively, in all the fruiting seasons (*Ambia, Mrug and Hasta*) over the years. Thus after sixteen years of constant nurturing of elite lime clones at AICRP (Fruits), Dr.PDKV, Akola was fruitful in the form of release of PDKV Bahar a prolific bearer variety for Maharashtra.

Keywords

Acid Lime Clones, AICRP (Fruits), Growth Yield and Quality

Introduction

In India the important citrus fruits grown are mandarins, sweet oranges and acid lime sharing 41 per cent, 23 per cent and 23 per cent respectively of total citrus fruit production in country. The acid lime group is most important particularly in tropical climate. Total 37000 ha area is under cultivation of acid lime in Maharashtra Acid limes are grown mostly in Akola and Buldhana districts of Vidarbha region, area in the vicinity of Wadegaon (Patur- Dist. Akola) is famous belt of acid lime. Though acid lime flowers throughout the year, the Ambia, Mrug and Hasta bahar are the main flowering seasons Ambia and Mrug in particular (Singh 2013). The summer cropping (Hasta bahar) fetches maximum prices to the farmer. The cultivars having high yield, juicy, thin peeled less seedy/ seedless and diseases resistant particularly citrus canker and *Phytophthera* characters having farmer's priority and also major breeding objectives for the acid lime breeding.

Selection, hybridization and mutation are major breeding methods followed for the Citrus crop improvement. (Singh and Singh, 2006). Commercial acid lime varieties viz. Balaji- a selection from Tenali, Jai Devi- a selection from ecotype of Kadyam tract, ARL-1 a selection from Arunachal Pradesh

and Vikram, Pramalini - local selections from Maharashtra are evolved through selection.

Materials and Methods

The intensive survey was conducted for selection of superior genotype in the year 1998 to 2002. Initially plants were evaluated in situ. Acid lime trees having higher yield potential and better quality were selected from local acid lime orchard of Maharashtra and planted at AICRP (Fruits), Dr. PDKV, Akola. A pedigree record of mother plants was also maintained for last 15 year. Selection was made for better fruit yield and quality (large size, thin peel, shining and juicy fruits).

Finally five elite clones were evaluated (2009-14) against commercial varieties viz. PDKV lime and Saisarbati in RBD replicated thrice.

The growth observations viz. plant height, East-West and North –South spread, plant volume, tree girth were recorded from period (2009-10 to 2013-14) at the end of the season. However yield and quality parameters were reported from the fruits of Ambia, Mrug and Hasta bahar and total yield yield /tree/year worked out from the all the season. Based on yielding ability and quality superior one proposed for release as a variety.

Results and Discussion

The data recorded on height, spread and canopy volume of Acid lime revealed that treatment clone 2 (PDKV Bahar) was superior and recorded significantly highest growth parameters i.e. height (4.32 m), spread (4.92m) and canopy volume (55.460m^3) as compared to remaining clones and varieties. The similar findings for the variation in growth parameter were reported by Kamatyanatti, 2015a and Desai et al 1994.

The data recorded on number of fruits, fruit yield / tree, average weight of fruit revealed that clone 2 (PDKV Bahar) was superior and recorded significantly highest yield i.e. number of fruits i.e.1833/plant/year (*ambia bahar* 1120, *mrug bahar* 427.6 and *hasta bahar* 285.8), fruit yield (124.92kg/plant/year i.e. 34.54 tonnes/ha) and average weight of fruit (*ambia bahar* 63.57 g, *mrug bahar* 65.37 g and *hasta bahar*54.31 g) as compared to remaining clones and varieties. Kamatyanatti *et al* (2015), Kumar *et al* (2011) and Ranpise *et al* (1995) during their respective studies had similar trend for findings in acid lime clonal / varietal evaluation.

The data recorded on quality parameter of Acid lime revealed that variety PDKV lime recorded significantly highest percentage of juice (53.04 %) and Ascorbic acid (31.57 mg/100ml of juice) and where as clone 2 (PDKV Bahar) recorded maximum TSS (7.66 %) and acidity (7.18) where as Chakradhar seedless (PDKV Chakradhar) was less acidic compared to other varieties. Chakradhar seedless was less seeded and recorded 1.26 seed per plant as well as significantly minimum peel thickness (1.02 mm) which was followed by Clone 2 (1.62 mm). Deshmukh *et al* (2015), Kamatyanatti *et al* (2015), Kumar *et al* (2011), Ranpise *et al* (1995) and Tirthankar *eta*l (2004) during their respective studies had recorded similar variations for the quality parameters in clonal / varietal evaluation experiments.

The yield potential of PDKV Bahar lime was found higher compared to the other cultivated varieties of Kagji lime in Maharashtra(14.71% & 21.32 % respectively more than PDKV lime & Saisharbati), when evaluated together.

Table.1 Vegetative growth parameter of elite of Acid lime (2009-14)

	Plant Height(m)						**Mean spread (m)**						**Plant volume (m^3)**					
Clone	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean
1	3.25	3.31	3.4	4.26	4.47	3.74	4.05	4.23	4.45	4.45	4.55	4.35	27.83	30.97	35.18	44.08	48.33	37.28
2	3.90	4.10	4.12	4.56	4.90	**4.32**	**4.50**	**4.75**	**4.90**	5.07	**5.4**	**4.92**	**41.26**	**48.38**	**51.71**	**61.23**	**74.7**	**55.46**
3	3.40	3.46	3.52	4.30	4.57	3.85	4.00	4.21	4.45	4.76	5.06	4.5	28.41	32.07	36.42	50.95	61.12	41.79
4	2.70	2.76	2.85	4.05	4.30	3.33	3.75	3.98	4.00	**5.1**	5.40	4.45	19.85	22.83	23.81	55.02	65.55	37.41
5	3.65	3.70	3.75	4.25	4.60	3.99	3.55	3.81	4.05	4.33	4.75	4.10	24.01	28.07	32.12	41.65	54.28	36.03
PDKV lime	3.7	3.78	3.85	4.25	4.62	4.04	3.85	4.00	4.20	4.45	4.90	4.28	28.66	31.59	35.52	43.97	57.98	39.54
Saisarbati	3.55	3.61	3.70	4.15	4.45	3.89	3.70	3.88	4.00	4.13	4.47	4.04	25.42	28.4	30.92	36.95	46.45	33.63
Chakradhar seedless	3.25	3.40	3.47	4.01	4.25	3.68	3.40	3.60	3.75	4.01	4.30	3.81	19.62	22.99	25.51	33.67	41.08	28.57
F test	Sig	Sig	Sig	NS	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE(M)±	0.107	0.116	0.13	0.158	0.109	0.065	0.12	0.138	0.151	0.174	0.114	0.081	0.829	0.993	1.224	1.76	1.252	2.037
CD at 5%	0.314	0.34	0.382	0.464	0.322	0.189	0.353	0.406	0.445	0.512	0.336	0.235	2.438	2.922	3.601	5.176	3.682	5.899

Table.2 Yield parameters of elite of Acid lime (2009-14)

:	**No of fruits**																	
	Ambia						**Mrug**						**Hasta**					
Clone	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean
1	732	925	950	1213	1200	1004	259	360	350	301	350	324	153	255	270	245	268	238.2
PDKV Bahar/ Clone-2	**897**	**1070**	**1100**	**1231**	**1300**	**1120**	378	**480**	**470**	**385**	**425**	**427.6**	**204**	**300**	**310**	**290**	**325**	**285.8**
3	733	940	965	1223	1140	1000	259	365	360	288	320	318.4	153	252	255	238	260	231.6
4	711	920	945	1045	1020	928.20	253	358	352	310	350	324.6	151	253	260	219	235	223.6
5	677	880	905	1100	905	893.40	249	350	350	328	365	328.4	147	250	262	212	242	222.6
PDKV lime	743	955	980	1218	1110	1001	**403**	363	360	372	380	375.6	154	258	260	275	290	247.4
Saisarbati	699	899	924	1117	1040	935.80	249	352	349	342	365	331.4	149	250	252	260	270	236.2
Chakradhar seedless	670	750	815	900	860	799	225	301	240	304	280	270	140	225	245	201	260	214.2
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE(M)±	22.5	30.956	33.842	40.99	24.961	21.98	8.086	12.171	12.503	11.795	8.109	12.517	4.752	8.557	9.268	8.669	6.573	5.245
CD at 5%	66.2	91.058	99.549	120.57	73.424	63.65	23.787	35.802	36.778	34.696	23.853	36.254	13.978	25.172	27.264	25.502	19.336	15.19

Table.3 Yield parameters of elite of Acid lime (2009-14)

Weight of fruit (Kg)/ plant																		
	Ambia						Mrug						Hasta					
Clone	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean
1	40.94	55.6	57.28	69.58	68.76	58.42	57.05	15.36	21.58	20.99	17.54	19.36	18.97	14.05	15.17	11.17	11.82	12.12
PDKV Bahar/ Clone-2	54.71	**68**	**70.18**	**76.78**	**81.04**	**70.09**	**62.21**	**26.46**	**33.6**	**32.47**	**25.1**	**26.44**	**28.81**	**17.46**	**18.6**	**14.49**	**14.95**	**15.42**
3	43.24	56.8	58.47	63.35	64.31	57.23	60.17	15.79	22.26	22.26	16.42	17.38	18.82	13.97	14.28	11.12	10.95	11.81
4	41.23	53.4	54.99	55.02	53.69	51.66	59.15	14.92	21.49	21.5	17.37	18.24	18.7	13.68	14.35	9.7	10.63	11.33
5	41.97	53.9	55.56	56.79	46.72	51	63.23	15.68	21.99	22.02	18.82	19.06	19.51	14.47	14.9	9.44	9.98	11.46
PDKV	41.79	61.9	63.6	71.02	64.71	60.61	57.37	27.4	24.75	24.8	23.93	22.85	24.75	15.91	16.12	13.17	13.12	13.54
Saisarbati	44.73	57.6	59.27	67.38	62.72	58.34	65.27	16.18	23.23	23.2	20.52	21.22	20.87	15.21	15.54	11.72	11.39	12.56
Chakradhar seedless	26	30.1	30.97	34	34.53	31.12	39.58	9.03	13.61	10.11	13.73	11.79	11.65	9.25	9.62	7.73	10.47	8.54
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE(M)±	1.277	1.8	2.051	2.114	1.319	1.758	1.806	0.484	0.731	0.798	0.648	0.427	0.838	0.463	0.526	0.384	0.278	0.359
CD at 5%	3.758	5.31	6.033	6.217	3.879	5.092	5.314	1.423	2.151	2.348	1.905	1.256	2.428	1.362	1.548	1.131	0.818	1.039

Table.4 Yield parameters of elite of Acid lime (2009-14)

No of fruits/plant/year							**Total Yield (kg/ plant/plant)**						**Total Yield (tonnes/ha)**					
Clone	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean
1	1144	1540	1570	1759	1818	1566.2	116.96	84.97	94.03	101.7	98.12	99.16	32.34	23.49	26	28.13	27.13	27.42
PDKV Bahar/ Clone-2	1479	1850	1880	1906	2050	1833	**145.73**	**111.6**	122.3	**123.7**	**121.0**	124.92	40.29	30.88	33.84	34.21	33.48	34.54
3	1145	1557	1580	1749	1720	1550.2	122.23	86.53	95.01	96.73	91.68	98.44	33.8	23.93	26.27	26.75	25.35	27.22
4	1115	1531	1557	1574	1605	1476.4	119.08	81.96	90.83	86.22	81.69	91.96	32.93	22.66	25.11	23.84	22.59	25.43
5	1073	1480	1517	1640	1512	1444.4	124.71	84.09	92.45	88.25	75.52	93	34.48	23.25	25.56	24.4	20.88	25.71
PDKV	1300	1576	1600	1865	1780	1624.2	123.91	105.2	104.4	108.9	101.7	108.87	34.26	29.1	28.89	30.14	28.14	30.11
Saisarbati	1097	1501	1525	1719	1675	1503.4	130.87	89.01	98.04	102.3	94.63	102.97	36.19	24.61	27.11	28.29	26.17	28.47
Chakradhar seedless	1035	1276	1300	1405	1400	1283.2	77.23	48.4	54.2	51.84	58.73	58.08	21.35	13.38	14.99	14.33	16.24	16.06
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE(M)±	35.31	51.67	55.567	61.372	39.523	24.981	3.659	2.785	3.383	3.252	2.018	2.116	1.012	0.77	0.935	0.899	0.558	0.585
CD at 5%	103.8	151.9	163.4	180.5	116.2	72.354	10.764	8.191	9.951	9.565	5.935	6.127	2.976	2.265	2.751	2.645	1.641	1.695

Table.5 Avg. fruit weight (g) of elite Acid lime (2009-14)

Avg.Weight of fruit (g)																		
	Ambia						Mrug						Hasta					
Clone	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean
1	57.05	61.3	61.5	58.51	57.3	59.13	60.01	59.95	60.01	58.3	55.3	58.71	55.2	55	56.2	45.36	44.12	51.18
PDKV Bahar/ Clone-2	**62.21**	**64.6**	65.08	**63.62**	**62.34**	**63.57**	**70.4**	**70**	59.12	**65.12**	**62.2**	**65.37**	57.4	**58.2**	**60**	**49.92**	**46.01**	**54.31**
3	60.17	61.6	61.8	52.83	56.41	58.56	51.65	61	60	57.12	54.3	56.81	55.66	55.45	56	46.76	42.12	51.2
4	59.15	59.2	59.35	53.7	52.64	56.8	59.85	60.05	59.12	56.3	52.12	57.49	54.86	54.1	55.2	44.38	45.23	50.75
5	63.23	62.5	62.62	52.66	51.62	58.53	63.32	62.85	62.9	57.38	52.23	59.74	58.33	57.9	56.9	43.12	41.23	51.5
PDKV	57.37	66.2	66.2	59.47	58.3	61.5	68.79	68.2	68.1	64.03	60.12	65.85	61.8	61.7	62	47.92	45.23	55.73
Saisarbati	56.27	60.4	60.43	61.53	62.31	60.18	66.68	66	65.1	60.03	58.14	63.19	60.68	56.85	58.2	48.37	42.17	53.95
Chakradhar seedless	39.58	41	38.76	38.53	40.15	39.6	40.12	45.2	42.12	45.15	42.12	42.94	40.2	41.12	39.25	38.45	40.25	39.85
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE(M)±	1.806	2.01	2.189	1.947	1.251	1.055	1.714	2.035	2.185	2.073	1.256	1.236	1.695	1.849	2.029	1.677	1.039	1.29
CD at 5%	5.314	5.92	6.439	5.729	3.68	3.056	5.043	5.987	6.429	6.099	3.694	3.58	4.987	5.439	5.968	4.934	3.057	3.735

Table.6 Avg. volume of fruits (ml) of elite Acid lime (2009-14)

Av. Volume of fruits (ml)																			
Elite Plant No.	Ambia						Mrug						Hasta						
	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	Pulled Mean
1	52.49	55.76	55.35	53.83	53.86	54.26	55.21	54.55	54.01	53.64	51.98	53.88	50.78	50.05	50.58	41.73	41.47	46.92	51.69
PDKV Bahar/ Clone-2	57.23	**58.78**	58.57	**58.53**	**58.6**	**58.34**	**64.77**	**63.7**	53.21	**59.91**	**58.47**	**60.01**	52.81	52.96	54	**45.93**	**43.25**	49.79	**56.05**
3	55.36	56.06	55.62	48.6	53.03	53.73	47.52	55.51	54	52.55	51.04	52.12	51.21	50.46	50.4	43.02	39.59	46.94	50.93
4	54.42	53.84	53.42	49.4	49.48	52.11	55.06	54.65	53.21	51.8	48.99	52.74	50.47	49.23	49.68	40.83	42.52	46.55	50.47
5	58.17	56.89	56.36	48.45	48.52	53.68	58.25	57.19	56.61	52.79	49.1	54.79	53.66	52.69	51.21	39.67	38.76	47.2	51.89
PDKV lime	52.78	**60.2**	**59.58**	54.71	54.8	56.41	60.29	62.06	**61.29**	58.91	56.51	59.41	**56.86**	**56.15**	55.8	44.09	42.52	**51.08**	55.97
Sai sarbati	60.05	59.5	58.89	56.61	56.69	58.35	61.35	60.06	58.59	55.23	54.65	57.98	55.83	55.37	55.53	44.5	39.64	50.17	55.5
Chakradhar seedless	36.41	37.27	34.88	35.45	37.74	36.35	36.91	41.13	37.91	41.54	39.59	39.42	36.98	37.42	35.33	35.37	37.84	36.59	37.45
F test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE(M)±	1.662	1.831	1.97	1.792	1.176	0.956	1.577	1.852	1.967	1.908	1.18	1.126	1.56	1.682	1.826	1.543	0.977	1.169	0.96
CD at 5%	4.889	5.387	5.795	5.27	3.459	2.77	4.64	5.449	5.786	5.611	3.472	3.26	4.588	4.949	5.371	4.54	2.874	3.385	2.824
Cv %	6.229	6.686	7.286	7.068	4.558	4.042	5.705	6.603	7.339	7.159	4.603	4.668	6.108	6.658	7.257	7.368	4.801	5.571	3.245

Table.7 Quality parameters of elite acid lime(2009-14)

	Juice (%)						Ascorbic Acid mg/100 ml of juice					
Clone	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean
1	50.9	49.8	44.8	52.1	50.25	49.57	30.7	29.6	30.73	31.26	28.14	30.09
PDKV Bahar/ Clone-2	51.9	50.85	50.85	52.9	55.56	52.41	31	30.1	31	32.18	33.05	31.47
3	51	50.2	50.2	51	50.12	50.5	32.1	31.15	32.13	31.72	30.14	31.45
4	52.1	51.1	51.1	52.13	51.15	51.52	36.2	29.2	30.07	30.64	27.13	30.65
5	51.2	50.15	50.15	52.4	54.21	51.62	36.75	29.65	30.87	31.12	30.12	31.7
PDKV	53.2	52.15	52.15	53.2	54.5	**53.04**	31.68	30.6	31.58	31.84	32.14	**31.57**
Saisarbati	52.6	51.55	51.55	52.6	52.02	52.06	31.75	31.7	32.43	31.76	29.45	31.42
Chakradhar seedless	50.2	51.4	49.56	50.25	51.25	50.53	30.12	30.14	31.02	30.55	29.65	30.3
F test	NS	NS	NS	NS	Sig	Sig	Sig	NS	NS	NS	Sig	NS
SE(M)±	1.607	1.748	1.811	1.956	1.282	0.53	1.016	1.048	1.132	1.183	0.74	0.696
CD at 5%	4.729	5.141	5.328	5.754	3.771	1.536	2.987	3.081	3.331	3.481	2.177	2.016
Cv%	6.226	6.867	7.238	7.513	4.894	2.306	6.242	6.922	7.253	7.541	4.938	5.008

Table.8 Quality parameters of elite acid lime (2009-14)

	TSS						Acidity						No of seeds						Peel thickness (mm)
Clone	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	2009-10	2010-11	2011-12	2012-13	2013-14	Pulled mean	
1	8.15	7.2	7.2	8.02	8.1	7.73	7	6.85	7	6.13	6.85	6.77	13	12	12.67	11	11	11.93	2.08
PDKV Bahar/ Clone-2	8.2	8.56	8.6	8.4	8.2	**8.39**	7.1	7	7.1	7.1	7.6	**7.18**	12	11	13.00	12	10	11.6	1.62
3	8	7.1	7.1	8.12	8.3	7.72	6	6.20	6	6.7	7.2	6.42	11	11	11.67	11	9	10.73	2.04
4	8.1	7.25	7.25	8.25	8.01	7.77	6.2	6.4	6.2	6.15	7.05	6.40	10	9	10.67	11.66	11	10.47	2.15
5	8	7.8	7.01	8.16	7.89	7.77	6.3	6.4	6.3	6.2	7.01	6.44	9	8	9	10	10	9.2	2.1
PDKV	8.65	7.6	7.66	8.55	8.1	8.11	6.75	5.7	6.75	6.51	7.2	6.58	11	10	11.33	11	11.24	10.91	1.85
Saisarbati	8.75	7.65	7.65	8.04	8.3	8.08	6.8	5.75	6.8	6.8	6.9	6.61	12	11	12	12	11	11.6	1.98
Chakradhar seedless	7.4	7.5	7.1	7.15	7.05	7.24	5.6	5.6	6.3	6.4	5.5	5.88	1.2	1.4	1.3	1.2	1.2	**1.26**	1.02
F test	NS	NS	NS	NS	NS	Sig	N.S.	Sig.	N.S.	NS	NS	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE(M)±	0.092	0.096	0.1	0.11	0.071	0.025	0.083	0.084	0.094	0.1	0.068	0.029	0.314	0.32	0.389	0.365	0.188	0.333	0.059
CD at 5%	0.269	0.284	0.296	0.324	0.208	0.073	0.243	0.246	0.278	0.295	0.201	0.083	0.925	0.955	1.14	1.075	0.554	0.966	0.174

Table.9 Leaf infestation due to leaf miner in acid lime genotypes (2009-10 to 2013-14)

Tr. No.	Treatment Acid lime genotype	Leaf infestation due to leaf miner (%)					
		2009-10	2010-11	2011-12	2012-13	2013-14	Mean
1	Clone-1	21.36 (27.45)	16.16 (23.65)	16.39 (23.85)bc	11.24 (19.54)	18.67 (25.58)bc	16.76 (24.17)
2	PDKV Bahar/ Clone-2	20.29 (26.71)	14.72 (22.43)	19.39 (26.07)c	16.31 (23.82)	15.99 (23.56)ab	17.34 (24.61)
3	Clone-3	19.22 (25.85)	15.72 (23.22)	11.36 (19.60)a	13.45 (21.25)	15.81 (23.43)ab	15.11 (22.87)
4	Clone-4	19.71 (26.29)	12.98 (21.06)	13.27 (21.34)	11.59 (19.86)	13.54 (21.48)a	14.22 (22.13)
5	Clone-5	20.57 (26.94)	13.87 (21.68)	13.72 (21.56)	11.83 (19.83)	19.23 (25.99)c	15.85 (23.37)
6	PDKV-lime	21.09 (27.28)	12.06 (20.25)	12.57 (20.70)ab	9.01 (17.47)	13.39 (21.45)a	**13.62 (21.63)**
7	Sai Sharbati	22.54 (28.28)	12.12 (20.37)	12.94 (20.98)ab	11.67 (19.95)	14.11 (22.01)	14.68 (22.52)
8	Chakradhar	21.54 (21.58)	12.11 (20.37)	12.65 (20.78)	11.48 (19.85)	14.01 (21.90)	14.35 (22.35)
	SE(m)±	1.66	1.70	1.26	1.57	1.07	0.73
	CD at 5 %	5.12	5.25	3.87	4.84	3.29	2.25
	CV (%)	10.67	13.53	9.88	13.44	7.92	5.49
	F test	NS	NS	S	NS	S	NS

Table.10 Incidence of canker on different clones and varieties from 2009-2014

	Leaf infestation due to leaf miner (%)		Per cent Disease Incidence of Canker	
Clones/ Varieties	2013-14	Pooled Mean	**2013-2014**	**Pooled mean**
Clone-1	18.67 (25.58)bc	16.76 (24.17)	48.35 (44.05)	46.14 (42.78)
PDKV Bahar/ Clone-2	15.99 (23.56)ab	17.34 (24.61)	42.33 (40.59)	40.52 (39.51)
Clone-3	15.81 (23.43)ab	15.11 (22.87)	43.48 (41.24)	44.70 (41.94)
Clone-4	13.54 (21.48)a	14.22 (22.13)	44.05 (41.58)	46.53 (43.00)
Clone-5	19.23 (25.99)c	15.85 (23.37)	45.96 (42.68)	44.83 (42.03)
PDKV-lime	13.39 (21.45)a	**13.62 (21.63)**	49.32 (44.60)	45.59 (42.46)
Sai Sharbati	14.11 (22.01)	14.68 (22.52)	48.63 (44.21)	46.04 (42.73)
Chakradhar	14.01 (21.90)	14.35 (22.35)	61.17 (51.46)	56.28 (48.63)
'F' Test	1.07	NS	Sig	Sig.
S.E.±m	3.29	2.25	0.85	0.41
C.D. @ 5%	7.92	5.49	2.63	1.27

Table.12 Performance Indicator

		% more yield than					
Clone	**Yield t/ha**	**PDKV lime**	**Saisarbati**	**Plant character**	**No of seed per fruit**	**Peel thick ness (mm)**	**Acidity %**
1	**27.42**			**Thorny**	**11.93**	**2.08**	**6.77**
PDKV Bahar/ Clone-2	**34.54**	**14.71**	**21.32**	**Thorny**	**11.6**	**1.62**	**7.18**
3	**27.22**			**Thorny**	**10.73**	**2.04**	**6.42**
4	**25.43**			**Thorny**	**10.47**	**2.15**	**6.4**
5	**25.71**			**Thorny**	**9.2**	**2.1**	**6.44**
PDKV	**30.11**			**Thorny**	**10.91**	**1.85**	**6.58**
Saisarbati	**28.47**			**Thorny**	**11.6**	**1.98**	**6.61**
Chakradhar seedless	**16.06**			**Thornless**	**1.26 to no seed**	**1.02**	**5.88**

Table.13 Morphological characters of PDKV Bahar/ Clone 2 of Kagzi lime [*Citrus aurantifolia, Swingle*]

Sr.No.	**Characters**	**PDKV Bahar/ Clone 2**
1	Growth habit	tree is medium, hardy and semi vigorous,spreading with irregular branches, loose crown, foliage not dense with stiff and sharp spine
2	Leaves	Light green in colour, broadly elliptical, margin, apex obtuse, petiole narrowly winged distinctly articulated and strongly lemon sented.
3	Flowering	The inflorances axillary short racemose, 2-7 small flowers, white in the bud, calyx copulate, petals 4-5 no.
4	Fruit characters	Large ,round to oblong, yellow at maturity, smooth, thinned skin or papery rind, adherence very strong. Fruit axis solid, segments 9-10 no. pulp light greenish yellow, texture coarse, juicy, flavor good and sour.
5	Peel thickness	1.62 mm
6	Seed	9-10 and highly polyembryonic
7	Special characteristics	A high yielding, and the average weight of fruit is more than the other varieties . Numbers of fruits of per tree per year is 1833 fruits as against other varieties ranging from 1200-1400 per fruit per year and yield 124kg per plant per year compare to other varieties(58 kg to 108 kg per plant per year)

Reaction of acid lime genotypes to pest and disease

Least leaf infestation of leaf miner was onted on PDKV lime with 13.62 percent followed by Clone2 and Chakradhar seedless.

The incidence of canker in acid lime was observed throughout the season in all clones and varieties. However, in pooled result the maximum incidence was recorded in Chakradhar seedless variety 56.28 per cent. Clone No.2 recorded minimum disease incidence i.e. 40.52 per cent and intensity 8.03 percent which was significantly superior to all clones and varieties.

From the above experiment it can be concluded that, Clone 2 /PDKV Bahar of

acid lime was found to be superior and recorded highest growth, yield and quality parameters (TSS and acidity) and given maximum return as compared to the other remaining genotypes and check varieties under Akola conditions.

Such a variation exists in nature due to the natural heterozygosity and the spontaneous mutation is amply exist in acid lime (Singh, 2012), which form the base for the variability (Soost and Cameron, 1975). Such desirable variant can select, if found fruitful conforming cherished goal, can be further utilized (Powell, 1995, Waller, 1995). Hence, the experiment is suggestive of emphasis could be given on clonal selection, since hetrozygosity and variant due to the spontaneous mutation can be very well exploited for the identification of better type for the commercial exploitation.

References

Desai, U.T., Musmade, A.M., Ranpise S.A.., Kale, P.N.., Chaudhari, S.M. and Kulkarni, S.R, 19994, Studies on variability of acid lime J. Maharashtra Agri. Univ. 1991) 97-99

Deshmukh, G.N, alekar, A.N., Hirve, P.S.,2015. Performance of acid lime varieties for *Hasta bahar* under Akola conditions J.Hort. 2 (2) 12

Kamatyanatti, M.V.,Ramteke,MM., Baghel and Paithankar D.H. 2015. Performance of acid lime cultivars for *Hasta bahar* under semi arid conditions of Vidarbha J.Progressve. Agri. 6 (2)

Kumar, M. Partiban, S., Sarladevi,D. and Aruna, P. 2011. Evalution of acid lime cultivars for yield attributes. Asian J.Hort. 6(2) : 442-444

Powell.N.1995, Variety " Powell Summer Naval-Application No.89/004, Plant Var.J.8(2): 27-28

Ranpise,S.A. 1993. Assessment of kagzi lime selection for yield and quality. Ph.D. thesis,MPKV, Rahuri

Singh I.P. and Shyamsingh (2006), Citrus improvement though selection, hybridization and mutation, Proc. National Symposium on Citriculture: Road map from Feb. 22-24 at Umiam, Meghalaya pp. 60-64

Singh I.P. (2012), Citrus Biodiversity Conservation and Characterization, Compedium : Hitech Intervenetion in Citriculture pp 67

Soost and Cameron, 1975. Breeding Citrus - Genetics and nucellar Embryony. Improving Vegetatively propogated crops. academic Press New York, pp83-110

Tirthankar, S.S.,, Kuchanwar,O.D., Sarode, P.S., Wagh,S.P. 2004. Fruit quality of acid lime orchard in Akola district P.K.V. Research J. 28(2) 158-161

Weller, R. 1995. Variety Weller Red Application No 92/61 Plant Var. J. 8(4)43-44