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Seed cotton yield performance of different strains in national coordinated varietal trial 2020-21

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ABSTRACT

During 2020-21 total 87 strains were developed and tested for seed cotton yield in National Coordinated Varietal Trail on National Level at different locations of Khyber-Pakhtunkhwa, Punjab, Sindh and Balochistan. The results revealed highly significant differences among the strains on different locations. In set A in Punjab and KPK top performer strain was PC-2008, and in Balochistan best performance was observed in PC-2003. In Set-B highest seed cotton yield per hectare was harvested from PC-2014 in Punjab, in KPK maximum yield was obtained from PC-2011 and in Balochistan high performance strains were PC-2012, PC-2025 and PC-2030. IN Set-C PC-2039 was the best performer strain at Punjab, PC-2047 was best strain at KPK and Balochistan. In Set-D, on Punjab level maximum yield was covered by the PC-2068, in KPK PC-2073 and in Balochistan maximum yield was harvested from four strains i.e PC-2069, 2073, 2081 and 2083.

Keywords: Cotton, conventional, early maturing, yield, upland cotton.

INTRODUCTION:

Cotton crop stands vital in agriculture as well as textile sector of the economy. Pakistan is the fourth largest cotton producing country and the third largest consumer of cotton products (Abbas, 2020). It is contributed around 0.6% to GDP and 3.1% of the value added in the agriculture. During 2020-21 the crop was cultivated on 2,079 thousand hectares, reflecting a contraction of 17.4% as compared to last year's sown are of 2517 thousand hectares. The cotton production reduced by 22.8% to 7.064 million bales from 9.148 million bales last year. The cotton gaining declined by 15.58% due to the fall in the production of the cotton crop. In Pakistan cotton productivity is showing a declining trend over the last five year mainly due to lower resource use efficiency, imbalanced fertilized application, and especially reduce N use efficiency (NUE) (Saleem *et al.*, 2016; Ahmad *et al.*, 2020).

Unfavourable weather, low water availability and pest attack at most critical stages of plant development for reasonable for low cotton yield in Pakistan (Ahsan and Asif, 2021). While considering the demands and importance of cotton crop, the development of high yielding and superior quality cotton genotype is obligatory (Ahsan and Asif, 2021). Therefore, breeders are focusing to develop high yielding superior genotype (Ahsan and Asif, 2021). Narrow genetic base and less diverse cotton genotype are the main cause of yield decline (Ahsan and Asif, 2021). So far broadening the genetic base of the cultivars, genetically distant genotype should be used in developing high yielding cotton genotypes (Ahsan and Asif, 2021).

To obtain superior genotype it is necessary to properly exploit the available germplasm in the hybridization and introduction of new germplasm for creating ample genetic variation (Ahsan and Asif, 2021). Initiatives to reduce highly toxic synthetic chemicals inputs used in conventional cotton production such as better cotton initiatives (BCI) are attempted to address the negative environmental and health impacts of cotton production by developing standards for water stewardship, soil health, and biodiversity, among others (Bakhtavar *et al.*, 2015).

MATERIALS AND METHODS

National Coordinated Varietal Trial (NCVT) 2020-21 comprised on 87 coded candidate strains developed by the various cotton research institutes and private seed sector breeders (Table 1).

Zone	Institute/Station	Sets
D.I. Khan	Cotton Research Station D.I. Khan	A,B,C,D
Faisalabad	Cotton Research Station AARI Faisalabad	A,B
	Nuclear Institute for Agriculture and Biology (NIAB)	C
	National Institute for Biotechnology and Genetic Engineering (NIBGE)	D
Sahiwal	Cotton Research Station Sahiwal	A,B,C,D
Multan	Central Cotton Research Institute Multan (CCRI)	A,B,C,D
	Cotton Research Institute Multan (CRI)	A,B,C,D
Vehari	Cotton Research Station Vehari	A,B,C,D
Bahawalpur	Cotton Research Station Bahawalpur	A,B,C,D
Khanpur	Cotton Research Station Khanpur	A,B,C,D
Lasbela	Cotton Research Station Lasbela	A,B,C,D
Khuzdar	Khuzdar	A,B,C,D

Table 1: Locations of NCVT Trials in KPK, Punjab and Sindh Provinces.

These strains divided into four sets and were grown in different ecological zones of Punjab, Sindh, Baluchistan, and Khyber Pakhtunkhwa KPK. The experiment was carried out during the regular cotton season in a randomized complete block design (RCBD) with three replications. Each genotype was planted in a plot of four rows of 5 meters in length and spacing was held 75cm between, rows, and 30cm between plants. Gap filling and thinning was done accordingly to maintain the plant population. All cultural and agronomic practices was done as needed i.e., weeding, irrigation, inter-cultivation, fertilizer application, pesticide application. Picking of the plot was carried out at maturity and yield was determined as kg per hectare by multiplying the yield to the hectare area.

RESULTS AND DISCUSSION: In Punjab Set-A was conducted at seven locations (CRS-AARI Faisalabad, CRS Sahiwal, CCRI Multan, CRI Multan, CRS Vehari, CRS Bahawalpur, and CCRS Rahimyar Khan). Highest seed cotton yield (3085kg/ha and 2811kg/ha) was harvested from PC-2008 at CRI Rahimyar Khan and CRS Faisalabad. Lowest yield was produced by the PC-2001 i.e., 206kg/ha at CCR Institute Multan. In KPK trials was conducted at CRS D.I. Khan. At this location maximum yield (2332kg/ha) was produced by the PC-2008 and lowest yield (1060kg/ha) was harvested from PC-2006. In Baluchistan, PC-2003 was ranked highest with the seed cotton yield 2752 kg/ha at CRS Lasbela and minimum (1794kg/ha) yield was observed by the PC-2001 at Naal Khuzdar (Table 2).

Codes	CRS Swl	CCRI Mul	CRI RYK	CRS Fsd	CRS Vri	CRS D.I.K	CRS Bwp	CRI Mul	Naal Khuzdar	CRS Lasbela
PC-2001	1111	206	1934	1865	936	2055	1076	299	1794	2154
PC-2002	1083	476	1597	2239	689	1763	1041	538	1795	2513
PC-2003	1440	269	2344	2055	1248	2212	1435	526	2513	2752
PC-2004	1388	216	1750	2499	953	1349	1160	574	2274	2633
PC-2005	1395	602	2190	1792	931	2170	1423	670	1556	1795
PC-2006	1404	539	2007	1652	676	1060	1029	610	2034	2154
PC-2007	1278	432	1095	2053	399	1105	1064	454	2154	2034
PC-2008	1283	679	3085	2811	1511	2332	1268	969	2154	2513
Average:	**1298**	**427**	**2000**	**2121**	**918**	**1756**	**1187**	**580**	**2034**	**2318**
CD 5%	347.0	18.3	662.4	258.7	236.9	171.1	62.1	167.4	465.2	522.4
CD 1%	486.6	25.3	919.3	359.1	328.8	237.5	86.1	232.3	645.7	725.1
Significance	NS	**	**	**	**	**	**	**	*	*
CV%	**15.27**	**2.44**	**18.9**	**6.97**	**14.74**	**5.57**	**2.99**	**16.48**	**13.06**	**12.87**

Table 2: Seed cotton yield (kg/ha) of eight candidate strains tested in NCVT Set-A during 2020-21.

In Punjab Set-B was conducted at 7 locations (CRS-AARI Faisalabad, CRS Sahiwal, CCRI Multan, CRI Multan, CRS Vehari, Bahawalpur, and Rahimyar Khan). Highest seed cotton yield (4279kg/ha and 3453kg/ha) was harvested from PC-2011 and PC-2017 respectively at CRS Faisalabad. Lowest yield was produced by PC-2031 i.e., 335kg/ha at CRI Multan. In KPK trials was conducted at CRS D.I. Khan. At this location maximum yield (2497kg/ha) was produced by the PC-2024 followed by 2407kg/ha by PC-2016 and lowest yield (634kg/ha) was harvested from PC-2031. In Baluchistan trial was conducted at Naal Khuzdar and CRS Lasbela, on these two stations highest seed cotton yield was harvested (2752kg/ha) from three strains (PC-2012, PC-2025 and PC-2030) and lowest yield i.e., 1556kg/ha was harvested from PC-2028 and PC-2029 at Naal Khuzdar (Table 3).

Codes	CRS Swl	CCRI Mul	CRI RYK	CRS Fsd	CRS Vri	CRS D.I.K	CRS Bwp	CRI Mul	Naal Khuzdar	CRS Lasbela
PC-2009	1018	872	2108	2875	1356	2310	1921	741	1675	2154
PC-2010	988	1336	2242	2315	1061	2384	1527	622	1795	2393
PC-2011	1067	1236	2137	4279	945	2076	2231	789	1675	2154
PC-2012	1905	1842	2499	1589	1340	1894	1754	801	2633	2752
PC-2013	918	825	2223	2173	1385	1179	1623	574	1915	2154
PC-2014	1848	457	2321	2123	1209	2497	895	395	2034	2274
PC-2015	1134	93	532	2219	614	1694	824	167	1915	2513
PC-2016	837	648	2727	2500	2107	2407	1802	873	2154	2393
PC-2017	995	1255	2383	3453	1373	2255	1420	741	2034	1795
PC-2018	913	974	2339	2528	1516	1218	1790	694	2034	2154
PC-2019	1020	1387	1715	1469	837	1450	1289	347	2274	2274
PC-2020	919	1596	2839	3023	1188	1745	1563	622	2274	2513
PC-2021	924	497	2775	2168	1424	1442	1897	741	2154	2154
PC-2022	1019	1319	2153	2297	1423	1663	1301	718	2393	2274
PC-2023	1014	967	1523	2816	1216	1339	1468	586	2034	2274
PC-2024	923	497	2610	2585	1703	1752	1683	861	1675	2154
PC-2025	1011	1191	2494	2276	1434	1684	1169	694	2752	2513
PC-2026	888	514	950	2327	730	1344	1110	299	2034	2274
PC-2027	907	2101	2037	1111	1782	1713	1026	813	1915	2513
PC-2028	1072	874	2223	2960	1703	1526	1146	574	1556	2034
PC-2029	783	905	1902	3302	1279	1889	1337	694	1556	2513
PC-2030	1499	1234	2575	1898	1760	1928	1731	741	2752	2034
PC-2031	898	1128	1179	2502	964	634	1217	335	1795	2274
PC-2032	932	731	2071	3472	1223	1855	1313	478	2034	1915
PC-2033	960	469	1644	2325	511	1724	1050	299	2034	1915
PC-2034	1035	789	2532	3213	1525	1792	1563	993	1556	2034
Average:	**1055**	**990**	**2105**	**2531**	**1293**	**1746**	**1448**	**623**	**2025**	**2246**
CD 5%	177.28	168.55	616.06	257.23	395.31	274.55	465.48	199.78	377.58	571.28
CD 1%	236.35	224.7	821.33	342.93	527.03	366.03	620.57	266.34	503.38	761.63
Significance	**	**	**	**	**	**	**	**	**	NS
CV %	**10.25**	**10.38**	**17.84**	**6.2**	**18.65**	**9.59**	**19.6**	**19.56**	**11.37**	**15.51**

Table 3: Seed cotton yield (kg/ha) of twenty-six candidate strains tested in NCVT Set-B during 2020-21.

In Punjab Set-C was conducted at 7 locations (CRS-AARI Faisalabad, CRS Sahiwal, CCRI Multan, CRI Multan, CRS Vehari, CRS Bahawalpur, and CCRS Rahimyar Khan). Highest seed cotton yield 3420kg/ha was harvested from PC-2039 followed by the

PC-2037 (3205kg/ha) at Nuclear Institute of Agriculture and Biology NIAB Faisalabad. Lowest yield was produced by the PC-2024 i.e. 282kg/ha at CCRI Multan. In KPK trials was conducted at CRS D.I. Khan. At this location maximum yield (2631kg/ha) was produced by the PC-2047 followed by the 2220kg/ha by PC-2045 and lowest yield (1675kg/ha) was harvested from PC-2038. In Baluchistan trial was conducted at Naal Khuzdar and CRS Lasbela, on these two stations highest seed cotton yield was harvested (2751kg/ha) from PC-2047 at Naal Khuzdar and CRS Lasbela followed by the PC-2037 that produced 2631kg/ha at CRS Lasbela and lowest yield i.e., 1196kg/ha was harvested from PC-2038 at Naal Khuzdar (Table 4).

In Punjab Set-D was conducted at 7 locations (CRS-AARI Faisalabad, CRS Sahiwal, CCRI Multan, CRI Multan, CRS Vehari, CRS Bahawalpur, and CRS Rahimyar Khan). Highest seed cotton yield 2935kg/ha was harvested from PC-2068 at CRI Rahim Yar Khan followed by the PC-2074 (2821kg/ha) at CRI Rahim Yar Khan. Lowest yield was produced by the PC-2081 i.e., 181kg/ha at CRI Multan (Table 5). In KPK trials was conducted at CRS D.I. Khan. At this location maximum yield (2714kg/ha) was produced by the PC-2073 followed by the 2649kg/ha by PC-2076 and lowest yield (1369kg/ha) was harvested from PC-2079. In Baluchistan trial was conducted at Naal Khuzdar and CRS Lasbela, on these two stations highest seed cotton yield (2752kg/ha) was harvested from PC-2069, PC-2073, PC-2081 and 2083 at CRS Lasbela, lowest yield i.e. 1436kg/ha was harvested from PC-2064 at Naal Khuzdar (Table 5).

Codes	CRS Sahiwal	CCRI Multan	NIAB Fsd	CRI RYK	CRS Vehari	CRS D.I.K	CRS Bwp	CRI Multan	Naal Khuzdar	CRS Lasbela
PC-2035	1545	661	2487	1701	501	1867	907	383	1674	2512
PC-2036	972	817	1938	1898	611	2078	943	347	1555	2392
PC-2037	1180	870	3205	2579	1114	2112	1790	1040	1435	2631
PC-2038	1283	1404	2392	3326	1579	1675	1921	1220	1196	1794
PC-2039	923	1374	3420	1849	1270	1891	1539	849	1674	2512
PC-2040	1938	719	2033	2805	849	1921	1098	371	1674	2512
PC-2041	863	1336	3062	2259	1205	1928	1337	670	1555	2512
PC-2042	846	577	2607	2589	1365	1897	1241	514	1435	2153
PC-2043	1517	651	3157	2558	1238	2171	1360	741	1674	2512
PC-2044	966	282	1124	1387	152	2171	418	163	1435	2512
PC-2045	1887	872	2153	2150	905	2220	1337	419	2033	2512
PC-2046	1064	863	2727	2301	2137	1920	1444	801	1914	2153
PC-2047	1302	1433	1938	2552	1778	2631	1157	1064	2751	2751
PC-2048	1094	1141	2511	2370	1693	1988	1194	909	2033	2512
PC-2049	1081	1353	2129	2462	1524	2121	1647	945	1914	2153
PC-2050	943	505	2129	2256	1815	2410	1790	419	1674	2272
PC-2051	929	582	2081	1899	905	2380	1241	538	1674	2272
PC-2052	1385	1421	2201	2798	1851	2500	1050	873	2392	2870
PC-2053	947	744	2272	2378	1301	2007	1361	562	1794	2153
PC-2054	883	666	1937	2236	1740	1968	919	1386	2272	2870
PC-2055	1068	496	2248	2565	1139	2018	1157	454	2392	2512
PC-2056	1371	1169	2153	2666	1412	1977	1563	885	2512	2870
PC-2057	902	1028	1937	1906	1249	2141	1396	443	2512	3229
PC-2058	1032	601	2081	2698	638	2033	1540	347	2512	2870
PC-2059	921	786	2416	2799	1453	2064	1802	861	1914	2272
PC-2060	1771	1016	2727	2915	1670	1966	1623	1040	1914	2751
PC-2061	1010	859	2129	2574	1292	2103	1181	622	2153	2033
Average:	**1171**	**897**	**2341**	**2388**	**1274**	**2080**	**1332**	**699**	**1914**	**2485**
CD 5%	171.07	111.47	670.67	756.1	382.11	130.35	379.19	204.49	476.43	634.43
CD 1%	227.94	148.52	893.62	1007.5	509.14	173.68	505.25	272.47	634.81	845.34
Significance	**	**	**	**	**	**	**	**	**	*
CV %	**8.91**	**7.58**	**17.49**	**19.32**	**18.31**	**3.83**	**17.38**	**17.86**	**15.2**	**15.58**

Table 4: Seed cotton yield (kg/ha) of twenty-seven candidate strains tested in NCVT Set-C during 2020-21.

Codes	CRS Swl	CCRI Mul	CRI RYK	CRS Vri	CRS D.I.K	CRS Bwp	NIBGE Fsd	CRI Mul	Naal Khuzdar	CRS Lasbela
PC-2062	1539	533	2370	1121	2015	454	1882	431	1795	1675
PC-2063	1269	826	1992	790	2206	670	1770	538	1675	2034
PC-2064	997	691	2813	1683	2083	1077	2137	1094	1436	2034
PC-2065	850	806	2538	1017	2152	574	1945	359	1795	2274
PC-2066	1209	798	2244	1194	2254	765	2105	718	1675	2513
PC-2067	948	1138	2424	1121	2117	753	1339	825	1795	2274
PC-2068	1888	1080	2935	1232	2565	945	2073	1399	2633	2872
PC-2069	1283	774	2715	1846	2145	1052	2392	1256	2513	2752
PC-2070	767	448	1944	1310	2192	574	1993	771	2393	2393
PC-2071	815	624	2793	1047	2192	801	1690	736	2034	2154
PC-2072	1404	862	2260	1084	1848	945	1754	897	2393	2633

PC-2073	1320	731	2344	839	2714	1040	1052	395	2393	2752
PC-2074	1501	755	2821	1235	2026	1053	1945	736	1795	2513
PC-2075	1296	405	1604	1027	2297	813	1563	574	2154	2513
PC-2076	1510	1105	2616	1735	2649	1100	2201	825	2034	2513
PC-2077	1269	833	2941	1014	2378	1208	2137	682	1795	1915
PC-2078	1458	840	2685	1236	2399	1005	1882	825	2274	2633
PC-2079	972	590	2019	1162	1369	969	1850	448	1915	2274
PC-2080	889	543	2770	1559	2147	670	2009	1094	2393	2513
PC-2081	859	470	1259	1404	2173	550	1244	144	2513	2752
PC-2082	1539	1195	2302	1127	2009	741	1914	771	2513	2633
PC-2083	1593	1114	2700	1619	2083	1028	2105	969	2752	2752
PC-2084	1415	861	2481	1502	1933	909	2009	1184	2154	2633
PC-2085	1620	1072	2777	1448	2395	789	1706	897	1915	2274
PC-2086	1004	547	2249	748	2150	682	2296	484	1795	2154
PC-2087	1242	367	2545	908	2096	945	1914	1579	1795	2633
Average:	**1248**	**770**	**2428**	**1231**	**2176**	**850**	**1881**	**793**	**2089**	**2425**
CD 5%	223.79	96.24	729.76	399.75	178.25	214.67	317.6	246.85	499.75	584.05
CD 1%	298.35	128.31	972.91	532.95	237.64	286.19	423.42	329.09	666.26	778.66
Significance	**	**	**	**	**	**	**	**	**	*
CV %	10.93	7.63	18.32	**19.4**	4.99	15.39	10.29	18.97	14.58	14.68

Table 5: Seed cotton yield (kg/ha) of twenty-six candidate strains tested in NCVT Set-D during 2020-21

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