Growth performance and response of three biotic agents in commercially grown eucalyptus clones in agroforestry

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ABSTRACT : The present study documents field performance of 21 commercially grown clones (BCM 7, BCM 271, BCM 288, BCM 316, BCM 411, BCM 413, BCM 526, BCM 2023, BCM 2045, BCM 2070, BCM 2135, BCM 2306, BCM 2313, Wimco 12, Wimco 14, Wimco 15, K 23, K 25, EC 4 and unnamed one belonging to different *Eucalyptus* species including a seedling population of locally collected *Eucalyptus* hybrid as control). Clones were evaluated for their growth and susceptibility to three biotic agents *viz*. *Leptocybe invasa* causing gall induction, *Cylindrocladium quinqueseptatum* causing leaf blight and *Botryosphaeria* spp. causing stem canker. Clones were planted in a randomized block design with five replications and five trees in each replication. Wheat was grown as intercrop in field during first and second winter seasons; however, no intercrop was grown during summer seasons. The results indicate significant variation for height, DBH, clear bole length, crown diameter among the tested clones. Ratings of individual clones for growth index (GI), susceptibility index (SI), and composite growth and susceptibility index (GSI) for gall, leaf blight and stem canker also showed significant variation among clones. GSI indicated that clones Wimco 12, BCM 526 and BCM 316 were superior over other clones. The results also confirm the superiority of clone Wimco 12 of *E. grandis* over many of the existing commercially grown clones of *E. tereticornis* and *E. camaldulensis*.

Key words: Biotic agents, commercially grown clones, *Eucalyptus*, growth and indices.

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1. INTRODUCTION

Eucalypts is one of the main planted forest trees in many parts of the country. There are over 600 species under the genus *Eucalyptus* (Turnbull, 1999) which provide a very wide genetic variability, ecological adaptability, resistance/susceptibility to diverse biotic and abiotic agents making them useful for research and field plantings. Around 170 species, varieties and provenances have been tried in India (Palanna, 1996). *Eucalyptus camaldulensis, E. tereticornis, E. grandis, E. citriodora* (*Corymbia* sp.)*, E. globulus, E. pellita, E. torelliana, E. urophyla,* their hybrids and clones have been field planted in many locations. India, with 3.9436 M ha area under its plantations, represents 22% of the global planted eucalypts (www.git.forestry.com) and, therefore, is among the main eucalyptus growing countries. Eucalyptus has now become the back bone for paper and pulp, particle board, MDF and hosts of other wood based industry. Of late, it is grown as a cash crop by numerous small growers on their farm-land in many parts of the country. Because of its immense social, silvicultural, commercial and industrial importance; eucalyputs is among the extensively researched trees for various aspects. There have been a lot of research inputs on introduction trials of its different species and seed sources; hybridization, selection and development of productive, site matched and resistant clones for different locations across the country as referred by Tewari (1992) and ENVIS (2014) and more specifically for the *Terai* region (Chandra *et al.,* 1998; Dhiman and Gandhi, 2005 & 2014) relevant to the present study. Of late, the emphasis is on clonal culture (Lal *et al.,* 2006; Luna *et al.,* 2009; Dhiman and Gandhi, 2014) that gives high productivity and better economic returns to growers. Eucalyptus clonal culture has fast expanded in the recent decades and occupies around half of the total area under its plantations. During the beginning of this decade, around 500 million clonal plants were being produced from around 2 dozen clones (Dhiman and Gandhi, 2014) and the number is constantly increasing.

Eucalypts culture, in the recent years, was badly affected by three biotic agents *viz*. galls caused by the insect- *Leptocybe invasa* Fisher & Lasalle (Dhiman *et al.,* 2010; Roychaudhary *et al.,* 2016), Cylindrocladium leaf blight (CLB) caused by the fungus- *Cylindrocladium quinqueseptatum* (Sharma *et al.,* 1984; Mohan and Manokaran, 2013; Dhiman and Gandhi, 2014) and stem canker caused by the bacteria- *Botryosphaeria* spp. (Sharma *et al.,* 1984; Chandra *et al.,* 2016) in many locations of the country. The damage by these agents has been so heavy that many of the good growing but susceptible clones have been taken out of planting programs. Of late, the infection of gall insect, though, has been marginalized but still being observed at a low scale in some locations. Others like CLB and stem canker are still causing a lot of damage to eucalyptus culture involving some susceptible clones. This paper presents the field evaluation of most of the commercially grown clones in north India for growth and resistance/susceptibility to three existing biotic agents *viz*. gall insect, CLB and stem canker.

2. MATERIALS AND METHODS

The study involves 20 commercially grown clones as given in table below-

Species	Number of clones	Clone name
E. tereticornis (ET)	4	BCM 7, BCM 271, BCM 288 and BCM 316
E. camaldulensis (EC)	6	BCM 411, BCM 413, BCM 526, K 23, K 25 and EC 4
E. grandis (EG)	3	Wimco 12, Wimco 14 and Wimco 15
Intra-specific hybrids between *E. tereticornis* X *E. tereticornis* (HETET)	4	BCM 2023, BCM 2045, BCM 2070 and BCM 2135
Hybrid between *E. camaldulensis* X *E. tereticornis* (ECET)	1	BCM 2306
E. camaldulensis X *E. tereticornis* (ECET)	1	BCM 2306
E. pellita (EP)	1	Unnamed
Eucalyptus hybrid seedling population	1	Seedlings

The experiment was conducted in randomized block design with five replications having five trees in each replicated plot. The trial was laid out at 4 m × 2 m spacing on agriculture field in the R&D Centre of Wimco Seedlings, Bagwala, Rudrapur, Uttarakhand. The centre is located at 28° N latitude and 79° E longitude and 200 m above mean sea level in the *Terai* region where water table is very near to the ground level.

Nodal cuttings of the tested clones were made from 30-45 days old coppice shoots collected from the clonal hedges grown at the Centre. Cuttings were treated with 0 to 5000 ppm IBA powder formulations in chalk powder as suggested by Dhiman and Gandhi (2017a) and planted in 50 cc root trainers cavities filled with horticulture grade vermiculite. The cuttings on setting in root trainers were placed inside mist chamber for 45 days which were shifted outside for hardening before being field planted when they were 20-25 cm tall. The field was well prepared with disc plough and leveled. Plants were planted in 30 cm cube pits on 23rd June, 2015. Wheat was grown as winter intercrop during first and second winter seasons inside the trial plantation and its results have already been reported (Dhiman and Gandhi, 2017b). No intercrop was grown during summer seasons. The growth data for height (Ht), diameter at breast height (DBH), clear bole length (CBL), crown diameter (CD) and rating of flowering were recorded on completion of 30 months age; whereas; the ratings for gall infection and CLB were made at 3 months and for canker and CLB again at 24 months age. Data on rating for gall, canker, and CLB infection was recorded on a scale between 0 to10 based on percent foliage/stem affected by the respective biotic agent. Zero rating was allotted for stem/foliage showing no visible signs of infection, whereas, 1 was allotted up to 10%, 2 for 11-20%, 3 for 21-30%, 4 for 31-40%, 5 for 41-50%, 6 for 51-60%, 7 for 61-70%, 8 for 71-80%, 9 for 81-90% and 10 for 91-100% foliage/stem affected by the respective biotic agent. The same scale was used for rating flowering based on percent branches flowered/tree in respective clones.

Growth index (GI), susceptibility index (SI), and composite growth and susceptibility index (GSI) were developed for each clone. For GI, X1 (height of the respective clone - minimum height of any clone under study), X2 (DBH of the respective clone - minimum DBH of any clone under study), X3 (CBL of the respective clone - minimum CBL of any clone under study) and X4 (minimum CD of any clone - CD of the respective clone) were considered and the simple equation used was: $GI=\sum X1....X4$. Crown diameter (CD) is an important parameter of trees for their adoption in agroforestry and hence adjustment for lower CD was made compared to other recorded growth parameters. Again, rating for flowering was not considered in the index since this stage of trial was too early to have uniform maturity for flowering in all the clones. Similarly, SI was developed by including ratings for gall and CLB for each clone at three months age and canker at 24 months age. This index includes the rating of no infection as control for resistance (0) and values of the three studied parameters as R1 (0 - gall rating of respective clone), R2 (0 - CLB rating of respective clone) and R3 (0 - canker rating of respective clone) by using the equation as, $SI=\sum R1....R3$. The rating for CLB at 3 months was higher than that recorded for 24 months age and hence the rating for CLB was considered only for three months age for SI. The GSI was developed by adding the values of both GI and SI. Data for growth parameters and rating was subjected to analysis of variance for drawing inferences and comparing clones among each other.

3. RESULTS AND DISCUSSION

Clonal performance

Growth performance: Data given in Table 1 indicate significant differences among clones for height, DBH, CBL and CD. Maximum height (14.6 m) was recorded in Wimco 12 which was statistically at par with BCM 2306 but significantly different from all other clones including seedlings. A minimum height (10.2 m) was recorded in Wimco 15. Overall, for height, 15 clones (BCM 7, BCM 316, BCM 411, BCM 526, BCM 2023, BCM 2045, BCM 2070, BCM 2135, BCM 2306, BCM 2313, Wimco 12, K 23, K 25, and EC 4) were above and remaining 6 clones were below trial mean height of 12.5 m. DBH, also showed significant differences among clones. Wimco 12 again recorded a maximum value of 11.8 cm which was statistically at par with BCM 316, BCM 526, BCM 2306, BCM 2023, and K 23. Whereas, Wimco 14 on the other hand, recorded a minimum DBH (7.7 cm). Overall, for DBH, 10 clones (BCM 7, BCM 316, BCM 526, BCM 2023, BCM 2135, BCM 2306, BCM 2313, Wimco 12, K 23 and EC 4) were above and remaining 11 clones were below trial mean. Maximum CBL of 9.1 m was recorded in BCM 316 which was statistically at par with BCM 526 and BCM 2045 but significantly higher than remaining ones whereas, Wimco 15 had a minimum CBL *i.e.* 3.5 m. Twelve clones (BCM 7, BCM 271, BCM 316, BCM 411, BCM 413, BCM 526, BCM 2023, BCM 2045, BCM 2135, Wimco 12, K23, and EC 4) were above and remaining 9 including seedlings were below mean CBL of 6.0 m. Crown diameter was maximum of 3.3 m in BCM 2306 which was significantly higher in comparison to other clones including seedlings; whereas; Wimco 15 recorded minimum CD of 2.1 m. Overall, 11 clones (BCM 7, BCM 526, BCM 2023, BCM 2045, BCM 2070, BCM 2135, BCM 2306,

Table 1. Clonal variation in growth and rating for three biotic agents

Sr. No.	Clone	Growth at 30 months age					Rating for susceptibility at			
							3 months age		24 months age	
		Ht (m)	DBH (cm)	CBL (m)	CD (m)	Flowering (%)	Gall	CLB	Canker	CLB
1	BCM7	12.8	9.7	6.6	2.7	1.60	2.15	1.00	0.88	2.00
2	BCM271	12.0	9.6	6.3	2.4	0.50	2.70	2.50	1.18	4.00
3	BCM 288	12.4	9.4	3.8	2.4	0.00	2.00	4.38	0.10	3.65
4	BCM 316	13.7	10.9	9.1	2.3	0.00	1.50	1.00	0.20	3.00
5	BCM 411	12.3	8.8	7.5	2.0	0.00	1.70	1.00	1.90	4.00
6	BCM 413	12.8	9.6	7.5	2.3	0.00	2.00	2.63	0.90	2.50
7	BCM 526	13.5	10.8	8.6	2.7	0.00	2.00	1.00	0.60	1.20
8	BCM 2023	12.7	10.3	7.2	2.6	1.00	2.93	1.00	0.00	2.00
9	BCM 2045	12.9	9.2	8.0	2.6	0.00	2.90	1.00	0.00	3.00
10	BCM 2070	12.5	9.6	5.7	2.5	1.30	1.87	4.38	0.13	3.70
11	BCM 2135	12.6	9.7	7.4	2.7	1.65	2.10	2.12	0.10	2.55
12	BCM 2306	13.7	11.2	3.7	3.3	2.63	0.00	4.88	0.25	3.75
13	BCM 2313	13.3	9.9	4.2	2.8	4.50	0.00	2.13	0.00	2.00
14	Wimco 12	14.6	11.8	6.2	2.8	4.40	0.00	4.25	0.25	2.45
15	Wimco 14	11.1	7.7	4.9	2.3	4.73	0.00	3.38	0.00	3.85
16	Wimco 15	10.2	9.6	3.5	2.1	2.00	0.00	3.13	0.00	3.00
17	K 23	13.2	10.7	6.7	2.7	0.40	1.38	1.75	0.00	2.50
18	K25	12.5	9.5	5.4	2.4	2.30	0.40	1.05	0.00	3.30
19	EC 4	12.5	9.7	6.4	2.4	5.30	0.65	2.94	0.83	2.15
20	Unnamed	10.8	8.0	3.7	2.8	7.90	0.00	1.83	0.00	2.60
21	Seedlings	10.7	8.1	4.5	2.3	2.85	1.03	3.50	0.00	4.17
	Mean	12.5	9.7	6.0	2.5	2.05	1.30	2.42	0.35	2.92
	SE diff.	0.56	0.83	0.80	0.15	0.51	0.38	0.68	1.46	0.39
	$LSD_{0.05}$	1.09	1.64	0.28	0.28	1.08	0.76	1.34	1.86	0.76

BCM 2313, Wimco 12,K 23, and Unnamed) above and remaining 10 close were below trial mean of 2.5 m for CD. Dhiman and Gandhi (2005), while studying 32 seed sources of 8 eucalyptus species in *Terai* region, reported that seed sources of *E. grandis* and Mysore gum performed better when compared with seed sources of other species.

Effect of biotic agents: No gall infection was recorded on 6 clones *viz*. BCM 2306, BCM 2313, Wimco 12, Wimco 14, Wimco 15 and unnamed one, whereas, others including seedlings were having different degree of infection. BCM 2023 had maximum rate (2.93) which was statistically at par with that of BCM 271 and BCM 2045 but significantly higher than the remaining ones. Overall, for gall rating, 12 clones (BCM 7, BCM 271, BCM 288, BCM 316, BCM 411, BCM 413, BCM 526, BCM 2023, BCM 2045, BCM 2070, BCM 2135, BCM 2306, and K23) had gall rating above and 9 remaining below the trial mean of 1.3. Nine clones (BCM 2023, BCM 2045, BCM 2313, Wimco 14, Wimco 15, K23, K25 unnamed and seedlings) had no canker infection on the stem, whereas, BCM 411 had maximum canker rate of 1.9 which was significantly higher than all other clones. Overall, for canker rating, 6 clones (BCM 7, BCM 271, BCM 411, BCM 413, BCM 526, and EC 4) were above and 15 remaining below trial mean of 0.35. Minimum CLB rate of 1.0 at three months age was recorded in 6 clones (BCM 7, BCM 316, BCM 411, BCM 526, BCM 2023, and BCM 2045). BCM 2306 had maximum infection rate of 4.88 which was statistically at par with BCM 288, BCM 2070 and BCM 2313 but significantly higher than other clones under study. Overall, for CLB at three months age, 11 clones (BCM 7, BCM 316, BCM 411, BCM 526, BCM 2023, BCM 2045, BCM 2135, BCM 2313, K 23, K 25, and unnamed) were below and 10 remaining were above trial mean rating of 1.3. At 24 months age, 7 clones (BCM 316, BCM 411, BCM 413, BCM 2045, and Wimco 12) showed minor changes in CLB rating compared to 3 months infection. Clonal variation in terms of gall induction, CLB and stem canker infection among different clones has been reported during the last one decade by many authors (Kumar *et al.,* 2007; Dhiman and Gandhi, 2013 and 2014; Kulkarni, 2014). Mohan and Manokaran (2013) while screening plantations of 110 clones for diseases in the state of Kerala also observed clonal variation for CLB infection. There have also been some efforts to categorize eucalyptus species and clones according to their susceptibility to CLB infection and gall induction (Kulkarni, 2008; Dhiman *et al.,* 2010; Balu *et al.*, 2013).

Flowering: There was no flowering in 6 clones *viz*. BCM 288, BCM 316, BCM 411, BCM 413, BCM 526, and BCM 2045 at 24 months of age, whereas, unnamed clones of *E. pellita* showed maximum flowering rating of 7.9 in its branches which was significantly higher than all other clones in the study. Two clones *viz.* BCM 271 and K 23 had minor flowering of around 5% branches at this age. Seven clones (BCM 2306, BCM 2313, Wimco 12, Wimco 14, K 25, EC 4 and unnamed) had above and remaining below the trial mean value for flowering rate of 2.05. Published information indicates that flowering in trees is influenced by genetics and environmental factors (Johnson, 1949). All clones under study were grown on the same field, and, hence this variation could be attributed to clones having different genetic makeup.

Species performance

Growth performance: The data of the studied parameters of clones grouped among different species and hybrids is given in Table 2 which show variation in terms of growth and response to the recorded biotic agents. A maximum of 13.7 m height was recorded for HETEG (13.7 m), followed by HECET (13.3 m), EC (12.8), ET & HTC (12.7 m), EP (10.8) and a minimum for seedlings (10.7 m). There were 5 species/hybrids above average and 3 below trial mean of 12.5 m. For DBH, maximum value of 11.2 cm was also recorded for HETEG, followed by HECET, ET & EC (9.9 cm), EG & HTC (9.7 cm), seedlings (8.1 cm) and EP (8.0 cm). There were 6 species/hybrids above and 2 below trial mean of 9.7 cm. CBL was maximum in HETET (7.1 cm), followed by EC (7.0 cm), ET (6.5 cm), EG (4.9 cm), seedlings (4.5 cm), HECET (4.2 cm) and EP & HETEG (3.7 cm). There were 3 species/hybrids above and 5 below trial mean of 6.0 m for CBL. Crown diameter was maximum (3.3 m) in HETEG, followed by 2.8 m in HECET & EP, 2.6 m in EC, 2.5 m in ET, 2.4 m in EC & EG and 2.3 m in seedlings. There were 5 species/hybrids above and 3 below trial mean of 2.5 m. Chandra *et al.* (1998) also reported growth variation in eucalyptus species and provenance grown in the same *Terai* region.

Effect of biotic agents: Species/hybrids also showed variation for tolerance to the exiting three biotic agents. No gall infection was recorded in EG, EP, HETEG and HECET; whereas; it was 1.03 in seedlings, 1.35 in EC, 2.1 in ET and a maximum rating of 2.5 in HTC. Rating for canker was maximum of 0.7 in EC, followed by 0.59 in ET, 0.25 in HETEG, 0.08 in EG and no infection in EP, HECET and seedlings. For

CLB rating at 3 and 24 months age; EG, HETEG and seedlings were above and that of EC, EP, HTC, and HECET below trial averages. Higher rating for three biotic agents reported here would mean higher susceptibility to the respective agent. Dhiman and Gandhi (2014) and Kulkarni (2014) reported variation in gall induction and CBL infection among different *Eucalyptus* species and hybrids

Flowering: Rating for flowering was maximum of 7.9 in case of EP, followed by 4.5 in HETCET, 3.71 in EG, 2.85 in seedlings, 2.63 in HETEG, 1.33 in EC, 0.99 in HTC and 0.53 in ET. There were 5 species/hybrids above (EG, EP, HETEG, HETEC, and seedlings) and 3 below (ET, EC, and HTC) trial mean of 2.05 at 24 months age. Variation in eucalypts species and populations for flowering is well reported by some authors (Griffin *et al.,* 1988; Law *et al.,* 2000)

Growth and susceptibility indices: Growth index developed from the deviation from trial mean for each parameter based on maximum value for height, DBH, CBL and CD is given in Table 3 which indicate that BCM 316 had maximum value of 12.0, followed by 10.8 for BCM 526, 10.4 for Wimco 12, 8.5 for K 23, 8.2 for BCM 2023, 8.1 for BCM 2045, 7.6 for BCM 2135, 7.2 for BCM 411 and 6.8 for EC 4 and all other clones had lower GI. For SI, BCM 271 with value of -7.9, BCM 411 with -7.6, EC 4 with -6.6, BCM 288 with -5.8, BCM 2070 with -5.7 had high susceptibility rating for the studied diseases and insect. Clones with less susceptibility were BCM 2313 (-2.0), unnamed (-2.6), K 23 (-2.5) and Wimco 12 (-2.7). Data on GSI indicate that Wimco 12 had maximum rate of 7.7, followed by BCM 316 (7.3) and BCM 526 (7.0), and these clones were better in terms of growth as well as resistance to the studied diseases and insect. Seedlings and unnamed clone had minimum value of -2.3, whereas, other clones like BCM 288, BCM 271 and Wimco 14 having values near to these clones. Developing indices for evaluating genotypes and species performance is a common practice in forestry (Cottreil, 1985). Dogra and Sharma (2005) developed an index for evaluating 16 eucalyptus species/provenances for growth and yield in south-west Punjab.

4. CONCLUSION

Clonal culture in India was initiated by Wimco Seedlings (Chandra and Yadav, 1986) during 1980's and was taken up more aggressively by others especially by ITC-PSPD to support its core business in paper and pulp 1990's onward. Most of the clones initially developed and planted in Andhra Pradesh were picked up for spreading clonal culture in other parts of the country. Many of these clones started facing problems related to adaptability and growth in new locations and, hence, numbers of new clones were developed by some local institutions. Three biotic agents *viz.* gall induction, CLB and stem canker infection have virtually creating havoc in eucalypt culture involving susceptible clones in many parts of the country. This study screened most of the commercial clones planted in India by including some others for specific *Terai* region and, as such, the good performing clones like, BCM 411, BCM 526, Wimco 12 in terms of their growth and relative resistance to the exiting biotic agent could now be more aggressively promoted for planting around the tested locations.

Table 2. Performance of species /hybrids in terms of growth and susceptibility to diseases and gall insect

Species	Clones (No.)	Height (m)	DBH (cm)	CBL (m)	CD (m)	Rating for flowering	Rating for susceptibility at			
							3 months age		24 months age	
							Gall	CLB	Canker	CLB
ET	4	12.7	9.9	6.5	2.5	0.53	2.10	2.22	0.59	3.20
EC	6	12.8	9.9	7.0	2.4	1.3	1.35	1.73	0.70	2.61
EG	3	12.0	9.7	4.9	2.4	3.71	0.00	3.58	0.08	3.10
EP	1	10.8	8.0	3.7	2.8	7.90	0.00	1.83	0.00	2.60
HETET	4	12.7	9.7	7.1	2.6	0.99	2.50	2.13	0.06	2.80
HETEG	1	13.7	11.2	3.7	3.3	2.63	0.00	4.88	0.25	3.75
HECET	1	13.3	9.9	4.2	2.8	4.50	0.00	2.13	0.00	2.00
Seedlings	1	10.7	8.1	4.5	2.3	2.85	1.03	3.50	0.00	4.17
Average	12.5	9.7	6.0	2.5	2.05	1.30	2.42	0.35	2.92	

Table 3. Growth and susceptibility indices for different clones

Clone	Height	DBH	CBL	CD	GI	Gall	CLB03	Canker	CLB24	SI	CGSI
BCM 7	2.6	2.0	3.1	-0.7	7.0	-2.2	-1.0	-0.9	-2.0	-5.0	2.0
BCM 271	1.8	1.9	2.8	-0.4	6.1	-2.7	-2.5	-1.2	-4.0	-7.9	-1.8
BCM 288	2.2	1.7	0.3	-0.4	3.8	-2.0	-4.4	-0.1	-3.7	-5.8	-2.0
BCM 316	3.5	3.2	5.6	-0.3	12.0	-1.5	-1.0	-0.2	-3.0	-4.7	7.3
BCM 411	2.1	1.1	4.0	0.0	7.2	-1.7	-1.0	-1.9	-4.0	-7.6	-0.4
BCM 413	2.6	1.9	4.0	-0.3	8.2	-2.0	-2.6	-0.9	-2.5	-5.4	2.8
BCM 526	3.3	3.1	5.1	-0.7	10.8	-2.0	-1.0	-0.6	-1.2	-3.8	7.0
BCM 2023	2.5	2.6	3.7	-0.6	8.2	-2.9	-1.0	0.0	-2.0	-4.9	3.3
BCM 2045	2.7	1.5	4.5	-0.6	8.1	-2.9	-1.0	0.0	-3.0	-5.9	2.2
BCM 2070	2.3	1.9	2.2	-0.5	5.9	-1.9	-4.4	-0.1	-3.7	-5.7	1.9
BCM 2135	2.4	2.0	3.9	-0.7	7.6	-2.1	-2.1	-0.1	-2.6	-4.8	2.9
BCM 2306	3.5	3.5	0.2	-1.3	5.9	0.0	-4.9	-0.3	-3.8	-4.0	1.9
BCM 2313	3.1	2.2	0.7	-0.8	5.2	0.0	-2.1	0.0	-2.0	-2.0	3.2
Wimco 12	4.4	4.1	2.7	-0.8	10.4	0.0	-4.3	-0.3	-2.5	-2.7	7.7
Wimco 14	0.9	0.0	1.4	-0.8	2.0	0.0	-3.4	0.0	-3.9	-3.9	-1.9
Wimco 15	0.0	1.9	0.0	-0.3	1.8	0.0	-3.1	0.0	-3.0	-3.0	-1.2
K 23	3.0	3.0	3.2	-0.1	8.5	-1.4	-1.8	0.0	-2.5	-3.9	4.6
K 25	2.3	1.8	1.9	-0.7	5.6	-0.4	-1.1	0.0	-3.3	-3.7	1.9
EC 4	2.3	2.0	2.9	-0.4	6.8	-0.7	-2.9	-0.8	-2.2	-6.6	0.2
Unnamed	0.6	0.3	0.2	-0.8	0.3	0.0	-1.8	0.0	-2.6	-2.6	-2.3
Seedlings	0.5	0.4	1.0	-0.3	1.6	-1.0	-3.5	0.0	-4.2	-5.2	-2.3

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