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Short communication

STANDARDIZATION OF ROW SPACING FOR MALT BARLEY UNDER TIMELY AND LATE SOWN CONDITIONS

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Barley (*Hordeum vulgare*) is ranked fourth after wheat, maize and rice in the context of area covered in the cultivation and the production level. Results of All India barley improvement crop project indicate that sowing time of barley differs in accordance with agro-climatic zones of the country. Too much delay in the time of sowing, however, results in the reduction of crop yield. This is mainly because of low temperature prevailing at the time of sowing. Not only this, when crops are sown late, they mature slightly late. The grains of such late sown crop are shriveled due to hot and desiccating westerly winds prevailing during the months of March and April. Row spacing and direction had little effect on yield and yield components, water use, tillering, and light interception. The narrow rows intercepted more light than wide rows and the wide rows intercepted more light at solar noon in east-west compared to north-south rows. Hence, this experiment was carried out to find out the best row spacing and suitable sowing time for malt barley for increasing productivity.

Field experiment was conducted during Rabi season of 2009-10 at Agriculture Research Farm of Shri F.H. (P.G.) College of Science, Agriculture & Forestry, Nidhauli Kalan, Etah, (27 ^{0} 10' N and 78^0 50' E). The soil of experimental site was sandy loam in texture and contained 3.5g kg^{-1} organic carbon, 181.0, 25.6 and 292.0 kg available NPK ha^{-1}, respectively. Initial pH and electrical conductivity (dSm^{-1}) was 7.9 and 0.18, respectively. The treatment comprised of two dates of sowing viz. 12th Nov. (Timely) and 12th Dec. (Late) at three different row spacings viz. 18, 20.5 and 23 cm. Recommended doses of P and K were supplied through DAP and muriate of potash, respectively as basal dose at the time of sowing along with one-third of the recommended dose of nitrogen through urea and rest 2/3rd nitrogen was applied at 40-45 DAS by top dressing of urea. The growth, yield attributes and yield were recorded at harvest.

Table 1: Growth and Yield attributes of malt barley as influenced by date of sowing and row spacing

Treatments	Shoots m^{-1} row length	Shoot height (cm)	DMA (g)	Length of Spike (cm)	Spikelet's Spike^{-1}	Fertile Spikelet's spike^{-1}	Ear head m^2	Grains / Ear head	1000 grain weight
Date of Sowing									
Timely (14 Nov)	94.82	85.86	44.12	6.52	27.28	25.18	425.82	40.82	34.42
Late (12 Dec.)	74.78	76.02	37.84	6.04	24.96	22.74	382.46	35.26	32.28
Sem±	2.63	1.15	1.05	0.07	0.38	0.36	8.32	0.92	0.94
CD (p=0.05)	11.84	5.18	4.73	0.32	1.71	1.62	37.45	4.14	NS
Row spacing(cm)									
18	83.87	79.82	30.05	6.24	25.61	23.32	396.40	37.46	32.58
20.5	84.68	81.35	41.83	6.28	26.33	24.20	413.24	38.62	33.52
23.0	85.85	81.65	41.06	6.32	26.42	24.36	402.78	38.84	33.50
Sem±	2.12	0.94	0.92	0.05	0.32	0.30	7.55	0.75	0.62
CD (p=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

Significantly differential growth and development behavior of barley crop were recorded due to different dates of sowing. The 12 November (D_1) sown crop showed superiority in all the growth parameters (number of shoots per meter row length, shoot height) resulting in profound vegetative growth. Under normal sown conditions (November 12) all the growth parameters were improved because the crop plants got enough time for completing their physiology in normal way, which ultimately affects the dry matter production. Hence, less dry matter production was obtained under late (December 12) sown conditions as compared to normal sown crop (November 12). The higher values of yield attributes (length of spike, number of spikelet's per spike, number of fertile spikelet's per spike, number spikes m^{-1} and number grains spike^{-1}) might be held responsible for higher grain yield. Whereas, growth

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characters namely number of shoots per meter row length, plant height and dry matter accumulation in plants might be held responsible for straw yield of barley under timely sown crop, as compared with late sown crop. Length of spike showed significant superiority by 7.9% over the late sowing date of 12 December (D_2). Spike per m^2 and grains per spike were significantly higher by 11.3 and 15.8%, respectively with timely sown than late sown crop. Date of sowing had no significant effect on 1000 grain weight. The crop sown at normal time remained in advantage and it completed its vegetative growth and development satisfactory due to favourable temperature conditions which ultimately accumulated more dry matter in plant and promoted the yield attributes favorably. Significantly higher biological yield was obtained from the barley crop sown on November (D_1) as compared December (D_2) sown crop and the increase was 22.3, 36.0 and 16.6 %, respectively. Harvest index did not differ significantly due to different dates of sowing. These results are in close conformity with the findings of Chakrawaty and Kushwaha (2009).

All the growth characters such as number of shoots per meter row length, shoot height, dry matter accumulation in plants did not differ much among themselves due to different row spacings. However, these growth characters marginally improved with every increase in the spacing and thus, maximum values were recorded with 23 cm row spacing. The 23 cm row spacing (S_3) had maximum dry matter. Row spacing's did not affect significantly the yield attributes. However, length of spike, number of spikelets and number of fertile spikelets per spike increased marginally with every increase in the spacing. Thus, the maximum value of these attributes was recorded with 23 cm row spacing. Whereas, spike per m^2, grains per spike and 1000 grain weight marginally higher with 20.5 cm spacing than that of 23 and 18 cm row spacing. Similar results were reported by Kushwaha *et al.* (2009) and Kaur *et al.* (2009).

Table 2: Yields and harvest index malt barley as influenced by date of sowing and row spacing

Treatments	Biological yield (qha^{-1})	Grain yield (qha^{-1})	Straw yield (qha^{-1})	Harvest Index (%)
Dates of Sowing				
Timely (14^{th} Nov.)	88.28	34.66	53.62	39.26
Late (12^{th} Dec.)	72.2	26.22	45.98	36.32
Sem ±	2.26	1.68	2.05	1.46
CD (p=0.05)	10.18	7.58	9.68	NS
Row Spacing(cm)				
18	80.26	29.82	50.44	37.15
20.5	81.96	32.85	49.11	40.08
23 .0	78.49	28.64	49.85	36.49
Sem ±	1.98	1.56	1.76	1.32
CD (p=0.05)	NS	NS	NS	NS

A perusal of the data (Table 2) clearly revealed that barley crop planted in rows 20.5 cm apart recorded higher total biological yield over the crop planted in row spacing 18.0 and 23 cm apart. As regard grain yield of barley, it was more with 20.5 cm row spacing and straw yield was higher with 23 cm spacing, but the variations in the yield (biological, grain and straw yield) were quite marginal and hence could not reach the level of significance. There were non-significant variations in harvest index due to different row spacing; however, the 20.5 cm row spacing gave numerically higher harvest index as compared to other two row spacing. The results are confirmed with the findings of Mani *et al.* (2008) and Khan *et al.* (2010).

It is concluded that plant growth yield and yield attributes improved with the normal sown crop (November 14) and different row spacing (18, 20.5 and 23 cm) had no effect on plant growth yield attributes and yield of barley.

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