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Effect of different date of sowing and granule sea weed extract (GSWE) on growth, yield attributes and yield of Wheat (*Triticum aestivum* L.)

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Abstract
An experiment was conducted at Uttar Pradesh in rural district Mandhana 10 km from Kanpur during rabi, season of 2022-23 on silty loam soil, having pH 7.65, EC 0.27 dSm^{-1}, organic carbon 0.41%, available N, P and K 217.0, 19.5 and 146.0 kg ha^{-1} respectively. The experiment was laid out in split plot design with three replication. The experiment was conducted with 12 treatment combination comprising three date of sowing (15 November-DS_1, 25 November-DS_2, 10 December-DS_3) in main plot and four treatments of granule sea weed extract (GSWE) in sub-plot ($GSWE_0$-Control@0 kg/ha, $GSWE_1$ @10kg/ha, $GSWE_1$ @15kg/ha, $GSWE_1$ @20kg/ha). Based on the experimental results 15 November date of sowing is superior over the remaining dates with application of $GSWE_3$ dose 20 kg/ha in respect growth parameters, yield attributes and yield.

Keywords: Wheat, date of sowing, GSWE, growth, yield attributes and yield

Introduction
Wheat records second crop after maize; in the year 2020-21, India produced 107.6 million tonnes of wheat, which was second position only to China's production of 134.3 million tonnes (WDI, 22). Wheat is a northern staple. Indian wheat-growing states include Uttar Pradesh, Punjab, Madhya Pradesh, Haryana, and Rajasthan. Uttar Pradesh had 9.85 million hectares of wheat land and 35.50 million tonnes of wheat output in 2020-21 (UPDES, 2022). Wheat is a main food and energy source in India. India is the world's second-largest wheat producer. Since independence, wheat production has risen from 6.60 to 107.6 million tonnes (WDI, 2022). Uttar Pradesh has the most land (35.1%) but the lowest productivity (2.7 tonnes/ha); hence it contributes the most to national production (35.03 percent). Wheat is grown in UP's west (3.29 million ha), east (5.24 million ha), and center (0.68 million ha). The protest and farmer fields yielded 1.35 tons/ha less. 2.7 tons/acre on 9.2 million acres. Critical production constraints in western Uttar Pradesh after growing rice-wheat, were decreasing soil organic carbon, mining for nutrients, inconsistent fertilization, crop waste burning that loses nutrients organic carbon, and lowering the water table and water availability also late sowing of wheat. The traditional cultural cultivation practices are also harmful for rice-wheat cropping system (Rizwana and lyaqet 2011) [11].

Recently, climate change and global warming have directly affected the crops yield and quality by intensifying the frequency and extent of numerous stresses. Wheat, rice, and maize are the most important staple crops globally and contribute a significant part of daily calories and protein intake (Kizilgeci *et al*., 2021) [8]. Environmental stress including salinity can cause about 50% of production losses (Acquaah, 2007) [1]. Furthermore, the continuous increase in the human population put pressure on global food security as the world's food supply needs to be increased by up to 70% by 2050 (FAO, 2009) [6].

The sowing time of wheat crop plays a pivotal role in a country like India, where climatic conditions vary throughout the country and delay in sowing decreases wheat grain yield by 58.2 percent. Wheat crop can effectively tolerate to severe low temperature and snow and continue growth start with the setting in warm weather with coming spring season. It can be successfully cultivated from mean sea level to 3300 altitudes. The average temperature at the time of grain filling and grain development are very crucial for maximum yield. The temperatures beyond 25 ^{0}C and above tend to depress grain weight. Global warming, as a result of climate change, may negatively affect wheat grain yields potentially increasing food

insecurity and poverty, although it should be noted that current effects of climate change in relation to wheat are inconclusive and model dependent (Tubiello *et al.*, 2000) [16]. In a diagnostic survey, it was estimated that around 30% area of wheat is sown during the month of November; the ideal or normal sowing time, 50% of wheat is sown during December; the late sown wheat and rest 20% area is commonly sown during first fortnight of January; the very late sown crop. It has been realized that the average yield of wheat of this region, sown during the month of November, is well comparable to the state average, but the declining trend in wheat yield has been noticed with delayed sowing i.e. in the month of December and January. It is mostly due to shorter growth period available to late sown wheat coupled with high temperature and hot winds during reproductive growth period, which leads to forced maturity and ultimately poor grain yield. The application of traditional chemical fertilizers has increased substantially as a result of the world's rapidly growing population and for growing food demand. The application of these chemical fertilizers and their adverse effects, particularly on the soil environment and their flora and fauna, has become a major threads (Eissa *et al*. 2017). As a further results, farmers instigated to switch to organic farming rather than using synthetic chemical fertilizers. Sea weeds extract (SWE) are abundant and sustainable and efficient resources found throughout coastlines hole world and are considered primary producers of food, feed, biofuels and fertilizers, nutraceuticals, and pharmaceuticals (Bixler and Porse *et al.* 2011) [2]. The sea weeds extract (SWE) had inspiring effect on growth and nutrient uptake because they were high in bioactive components like macro- and micronutrients, essential fatty and amino acids, vitamins several Harmon's like cytokinin's, and auxins. Which hasten cellular metabolism in treated plants, resulting in improved growth and productivity of wheat crop. With the limited scope for increasing the crop acreage besides the production threats and challenges at the fore front, the production target has been fixed at 140 mt and average yield at 47 q/ha by 2050. Thus, In the present investigation an efforts was made to evaluate the "To study the effect of different date of sowing and granule sea weed extract on growth, yield and yield attribute of wheat (*Triticum aestivum* L.)*"*

Materials and Methods

An experiment was conducted at Uttar Pradesh in rural district Mandhana 10 km from Kanpur during rabi, season of 2022-23. The experiment was laid out in split plot design with three replication. The experiment was conducted with 12 treatment combination comprising three date of sowing (15 November -DS_1, 25 November - DS_2, 10 December -DS_3) in main plot and four treatments of granule sea weed extract (GSWE) in sub-plot ($GSWE_0$ -Control@0 kg/ha, $GSWE_1$ @10kg/ha, $GSWE_2$ @15kg/ha, $GSWE_3$ @20kg/ha). The experimental field was prepared after pre sowing irrigation at proper moisture condition. The crop was fertilized and granule sea weed extract (GSWE) applied as per the treatment. The recommended dose of nitrogen, phosphorus and potassium @ 120 kg N according to treatments, along with 60 kg P_2O_5 and 40 kg K_2O ha^{-1}, respectively through Urea, single superphosphate and muriate of potash were applied. Half dose of nitrogen and full dose of phosphorus and potassium were applied and as basal dressing on 10th December, 2022. Remaining half dose of nitrogen through urea was top dressed in two equal doses on 11th January, 2023 and 28th January, 2023. Wheat cultivar HD 2967 was grown in the experimental field. A uniform seed rate of 120 kg ha^{-1}. The sowing of crop was done as per treatment in rows at 20 cm apart at 4-5 cm deep by seed drill. The soil of the experimental field was alluvial in origin and silty loam in texture and slightly alkaline in reaction having pH 7.65, EC 0.27 dSm^{-1}, organic carbon 0.41%, available N, P and K 217.0, 19.5 and 146.0 kg ha^{-1} respectively. The data obtained on grain yield were analysed statistically.

Results and Discussion

Growth Characters

It is visualized from the data given in table 1 among the growth characters *viz*; plant height, number of tillers, leaf area index and dry matter production were studied. Different date of sowing and granule sea weed extract of wheat crop was exhibited significant variation in plant height of wheat. The maximum plant height and dry matter accumulation, number of tillers, leaf area index of crop was estimated from sowing of crop in 15 November which were statistically at par with sowing of crop in 25 November. Similar finding has been reported by other workers Dhaka *et al*. (2006) [5], Shahzad *et al*. (2007) [13], Kumar and Sharma (2003) [9], Salim and Abdel-Rassoul, (2016) [12] and Gupta *et al*. (2017) [7].

The maximum plant height and dry matter accumulation, number of tillers, leaf area index of crop observed from application of granule sea weed extract ($GSWE_3$ 20 kg/ha) which were statistically at par with application of granule sea weed extract ($GSWE_3$ 15 kg/ha). Although, the minimum plant height and dry matter accumulation, number of tillers, leaf area index of crop growth from of wheat crop was projected from control plot ($GSWE_0$). Similar result has been found by Crouch *et al*., (1990) [3]; Stirk and Van Staden (2006) [15].

Yield and yield attributes

It is illustrated from the data given in table 2 that different date of sowing and application of granule sea weed extract (GSWE) was exhibited significant variation in yield attributes viz; length of ear, number of grains/ears, Number of spikelet's/ears and test weight of wheat crop. The maximum length of ear, number of grains/ears, and test weight of wheat crop was calculated from sowing of crop in 15 November which were statistically at par with sowing of crop in 25 November. The maximum length of ear, number of grains/ears, and test weight of wheat crop from application of granule sea weed extract (GSWE3 20 kg/ha) which were statistically at par with application of granule sea weed extract (GSWE3 15 kg/ha).

However, the maximum grain yield of wheat crop was estimated from sowing of crop in 15 November which were statistically at par with sowing of crop in 25 November but minimum values of these parameters were recorded from sowing of crop in 10 December. Among application of granule sea weed extract (GSWE), the maximum grain yield of wheat crop was calculated from application of granule sea weed extract (GSWE3 20 kg/ha) which were statistically at par with application of granule sea weed extract (GSWE3 15 kg/ha). Similar finding has been reported by many other scientist Vaghasia and Patel (1993) [17], Das *et al*. (1996) [4], Kumar and Sharma (2003) [9], Shahzad *et al.* (2007) [13], Pramanick *et al.,* (2012) [10] and Shankar *et al.,* (2015) [14].

Table 1: Plant height, numbers of tillers, leaf area index, dry matter accumulations as influenced by date of sowing and sea weed extract.

Treatments		Plant height (cm)	Numbers of tillers	Leaf area index	Dry matter accumulation (m^{-1} row length)
A. Date of Sowing					
1.	15 November	94.83	95.10	1.88	176.29
2.	25 November	92.13	89.35	1.83	172.16
3.	10 December	89.46	78.84	1.78	168.59
	C.D. at 5%	0.94	4.01	0.04	3.04
	SE(m)	0.32	0.99	0.02	2.72
B. Sea weed extract					
1.	$GSWE_0$ (Control)	90.35	84.07	1.82	170.76
2.	$GSWE_1$ 10 kg/ha	91.68	86.22	1.83	171.79
3.	$GSWE_2$ 15 kg/ha	92.66	88.38	1.84	173.95
4.	$GSWE_3$ 20 kg/ha	93.88	92.39	1.87	175.88
	C.D. at 5%	1.06	4.05	0.04	3.76
	SE(m)	0.38	1.91	0.03	2.66

Table 2: Yield attributes and yield of wheat as influenced by date of sowing and sea weed extract.

Treatments		No. of effective ear (m^{-1})	Length of ear (cm)	Number of grains/ears	Test weight (g)	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Harvest index (%)
A. Date of Sowing									
1.	15 November	94.81	46.40	20.67	43.08	53.82	77.54	131.37	41.74
2.	25 November	90.26	43.02	19.38	41.21	52.23	75.11	129.34	40.28
3.	10 December	85.92	39.55	19.03	39.13	46.74	73.79	127.53	37.77
	C.D. at 5%	4.04	1.63	0.90	1.86	2.31	1.75	3.47	1.82
	SE(m)	1.42	0.78	0.31	0.65	0.81	1.25	2.06	0.63
B. Sea weed extract									
1.	$GSWE_0$ (Control)	88.61	41.77	18.81	40.21	49.13	78.10	127.23	38.32
2.	$GSWE_1$ 10 kg/ha	89.87	42.79	19.21	40.61	50.18	79.31	128.50	39.25
3.	$GSWE_2$ 15 kg/ha	90.58	43.48	20.09	41.52	51.45	81.63	130.08	40.41
4.	$GSWE_3$ 20 kg/ha	92.26	44.91	20.66	42.24	52.96	82.88	131.84	41.74
	C.D. at 5%	0.97	1.13	0.89	0.92	2.32	2.92	2.42	1.81
	SE(m)	0.93	0.90	0.42	0.48	1.09	1.64	1.74	0.85

Conclusion

Based on the above result, it can be concluded that 15 November date of sowing is superior over the remaining dates with application of GSWE3 dose 20 kg/ha in respect growth parameters, yield attributes and yield. Thus sowing of wheat on 15 November with application of GSWE3 dose 20 kg/ha may be recommended to realized higher yields of wheat for farmers.

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