Wheat is the most important cereal crop of *rabi* season in the North-Western Himalaya with an acreage of 1.38 million ha. The cultivated area under wheat in the hilly regions of Uttarakhand, Himachal Pradesh and Jammu and Kashmir (J&K) is estimated to be 0.35, 0.36 and 0.29 million ha, respectively. Wheat production in the region is 1.83 million tones and productivity is only around 15.5 q/ha, which is below the national average (30.0 q/ha). However, presence of cool climate and comparatively longer crop season in the hills as compared to plains provides a tremendous scope to raise the current productivity level.

Majority of the farmers in this region forced to use their own farm saved seeds (which is of low productivity) due to non-availability of right seed at right place and right quantity. Under this circumstance they resort to use local farmer's varieties which are often heterogeneous mixtures of landraces of wheat. However, their genotypic ability to higher production is very low as well as they are highly susceptible to rust and other diseases. In spite of this, by adopting the recommended and scientific package of practices in wheat, the productivity level can be increased to 20-25 q/ha and 40-45 q/ha under rainfed and irrigated conditions, respectively.

Improved package of practices in wheat

The recommended improved package of practices and high yielding varieties of wheat for higher production in North-western hills are given in Table 1.

Sowing Time

Low and medium hills (upto 1700 mt AMSL)
Rainfed conditions

Early sown	Last week of September to first week of October
Timely sown	Second fortnight of October
Late sown	After month of October

Irrigated conditions

Timely sown	First fortnight of November
Late sown	After month of November

High attitude hills (more than 1700 mt AMSL)

Rainfed and timely sown conditions	Second fortnight of October

Seed rate
The seed rate depends on sowing time as well as recommended varieties.
Early and timely sown conditions
100 kg/ha (2 kg/nali)
Late sown conditions
125 kg/ha (2.5 kg/nali)
Varieties with medium sized grains
100 kg/ha (40 g/1000 grain weight)

Table 1. The details of improved high yielding and disease resistant/ tolerant varieties of wheat recommended for North-Western hilly regions

Sowing time	Varieties	Duration (days)	Area of recommendation	Yield potential (q/ha)	Other details
Low and medium hills (upto 1700 mt AMSL)					
Early sown rainfed conditions	HPW 251	200-215	Uttarakhand, HP and J&K	25-30	Wherever irrigation facility available, green fodder can be obtained by cutting the crop 5 -6 cm above the ground at 70-75 days after sowing. Additional supply of 30 kg/ha nitrogen just after cutting will ensure no reduction in the yield level.
	VL *Gehun* 829	200-218	-do-	25-30	-do-
	HS 542	200-222	-do-	32-33	-
Timely sown rainfed (RF) and irrigated (IR) conditions	VL *Gehun* 802	155-170	Uttarakhand hills	20-25(RF) 40-45(IR)	-
	UP 2572	170-175	Uttarakhand	45-45(IR)	Only for irrigated condition
	VL 804	164-178	Uttarakhand, HP, J&K, Manipur and West Bengal	25-30(RF) 40-45(IR)	-
	VL *Gehun* 907	165-175	-do-	25-28(RF) 40-45(IR)	Grain is rich in micronutrients
	HS 507	190-195	-do-	25-25(RF) 40-45(IR)	-
	HS 562	165-175	-do-	-do-	-
	VL *Gehun* 953	160-170	Uttarakhand hills and plains	33-33(IR)	Only for irrigated condition
Late sown rainfed conditions	HS 490	155-160	Uttarakhand, HP and J&K	20-25	-
	VL *Gehun* 892	140-145	-do-	30-35	Grain is rich in micronutrients
High attitude hills (more than 1700 m msl)					
Rainfed and timely sown conditions	HS 365	190-195	-do-	18-20	-
	VL *Gehun* 832	190-195	-do-	20-22	-
	HPW 155	170-190	-do-	25-30	-
	SKW 196	190-195	-do-	20-25	-

Varieties with small sized grains
75 kg/ha (35 g/1000 grain weight)
Varieties with large sized grains
125 kg/ha (45 g/1000 grain weight)

Method of Sowing

Wheat requires well pulverized clod free soil and it can be achieved by 2-3 rounds of ploughing. To achieve good germination and crop stand, the seed must be sown in moist soil at a depth of 5 cm. Seed drill can be used for sowing the seed at the optimum depth. Desi plough can also be used to open furrows of appropriate depth and seed dropped in the open furrows and covered by planking. The best results are achieved by the use of seed-cum-fertilizer drills. For early and timely sown conditions, wheat should be spaced 20 cm between rows. A closer spacing of 18 cm is recommended for late sown wheat.

Fertilizer Management

The quantity of manures and synthetic fertilizer can be applied depends mainly on type of wheat, time of sowing, availability of irrigation and nutrient status of soil. Combination of organic manure and chemical fertilizer give superior results than the use of chemical fertilizer alone. Application of Farmyard manure (10 ton/ha) before 15 days of sowing is beneficial to wheat crop. The chemical fertilizer doses can be decided based on soil test results. In general, the recommended doses are as follows:

Irrigated timely sown: 120-60-40 kg/ha N-P2O_5-K_2O (2.4-1.2-0.8 kg/nali N-P_2O_5-K_2O)
Rainfed/Restricted late sown: 90-60-40 kg/ha N-P_2O_5-K_2O (1.8-1.2-0.8 kg/nali N-P_2O_5-K_2O)
Rainfed early, timely and late sown: 60-30-20 kg/ha N-P_2O_5-K_2O (1.2-0.6-0.4 kg/nali N-P_2O_5-K_2O)

Under rainfed condition, full dose of nitrogen, phosphorous and potash should be applied as basal dose. Under irrigated condition, full dose of Phosphorous and Potash and one third of the dose of nitrogen should be applied as basal. Out of the remaining two-third of the dose of nitrogen, one-third should be top dressed after first irrigation (30-35 days after sowing) and rest one-third after second irrigation (60-65 days after sowing).

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Wheat

Package of practices for higher productivity

Irrigation schedule

During normal rainfall years in winter season, wheat requires 2-3 irrigations in the hills. First irrigation should be applied at 30 days after sowing, second at 55-60 days after sowing and third during seed setting. If enough rainfall occurs at any of the above stages, that particular irrigation can be omitted. If only limited water is available to irrigate two times, then first irrigation should be provided at 30 days after sowing and second at seed setting stage. If water is available only for one irrigation then first irrigation should be given at 30 days after sowing.

Weed control

To manage weeds in wheat field, two manual weedings are required at 30-35 days and 55-60 days after sowing.

The chemical methods of weed control are recommended where infestation of weed is very heavy and availability of labourers is limited . Post-emergence application of tank mixed herbicides (isoproturon a.i. @ 0.75 kg/ha + 2,4-D a.i. @ 0.5 kg/ha in 800-1,000 liter of water) against both grass and broad leaved weeds has been recommended. For the control of complex weed flora of grass and broadleaf weeds, the post emergence application of pre-mixture total (Sulfosulfuron + Metsulfuron) @ 32 (30+2) g a.i./ha in 800-1,000 liter of water is useful. The post-emergence herbicides should be sprayed 30-35 days after sowing (4-5 days after first irrigation to ensure sufficient moisture in the soil for better effectiveness of herbicide).

Disease control

Yellow and brown rust, loose smut, hill bunt, powdery mildew and karnal bunt are the main diseases prevalent in the North-Western hills. In yellow rust, small yellowish uredia appear in linear rows on the leaf. In brown rust, brown circular uredia normally appear on the upper leaf surface, but with severe epidemics sheath infection can occur. For control of brown and yellow rust, spray of Propiconazole 25 EC or Tebuconazole 250 EC@ 0.1 % (1 ml/litre) on affected crop is recommended. First round of spray shall be done immediately after disease appearance followed by second spray after 15 days interval.

Loose smut is an internally seed borne disease. The symptoms involve formation of black powder in place of wheat grains in the spikes. For effective control of loose smut, growing of disease free seed and seed dressing with Corboxin at the rate of 2.5 g per kg of seed before planting is recommended.

Pest control

In hills, damage by insect pests to wheat crop is not so severe. However, field rats cause heavy loss to wheat crop and do considerable damage to the harvested crop lying in stacks in the fields. For rat control fumigate live-burrows with aluminum phosphide at the rate of one tablet of 0.5 g per small burrow, and 3.0 g per large burrow. In case of appearance in the same field, phosphide poison bite at the rate of 15 g of prepared of bite (one part Zink Phosphide, one part mustard oil and 98 part wheat or maize grain flour) are placed inside the live-burrows and close it for their effective control.

Harvesting, threshing and storage

When the moisture content of the grains is about 25-30%, crop should be harvested. After harvesting, it should be sun dried and threshed with a pair of bullock or by using threshers. Harvesting of mature crop should not be delayed, because at that time the occurrence of rain and hailstorms are high. The grain should be dried properly so that moisture content remains between 10-12%. After keeping grains in warehouse, application of EDB @ 3.0 ml/q grains have been found effective against storage insect pest.

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Printing Assistance

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Published by Director, ICAR-VPKAS, Almora-263601 (Uttarakhand)
and Printed at Design APNA JANMAT, Dehradun
Tel. : 0135-2653420, 9837209996

ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan
(An ISO 9001 : 2008 Certified Institute)
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2017

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