

### Crop management

Growing of wheat crop in rotation with *kharif* leguminous crops (soybean, black soybean, horsegram, pigeonpea, etc.) enhances the grain yield. Spraying of *jeevamrit* (prepared from cow dung, cow urine, jaggery, chickpea flour and undisturbed forest soil) @ 500 litres per ha twice a month enhances the yield. Spraying of 3% *panchagavya* and vermiwash enhances the soil health and grain yield.

### Weed control

Broadleaf (dicot) weeds pose more serious problem than grass weeds (monocot) in the northern hill zone, which is ironic to the plain areas. In rainfed situation, *Anagallis arvensis* (*Krishna neel*), *Chenopodium album* (*Bathua*) and *Lathyrus aphaca* (*chatri matri*) are of major concerns. The mechanical weeding at 30-35 and 110-120 days after sowing with help of *khurpi* is generally recommended in rainfed situation, because it helps to conserve moisture. The second weeding is delayed up to 110 days; because new weeds emerge as the temperature rises in the month of February. The improved farm equipment like wheel hoe and hand hoe can be utilised for mechanical weeding for cost-effective and efficient weed management. Changing of cropping system in a land automatically reduces weed pressure.

### Disease management

**Rust (*Puccinia striiformis* f. sp. *tritici*, *Puccinia recondita* f. sp. *tritici*):** Rust is the most important disease of wheat.

Stripe rust pustules are yellowish-orange, much smaller and are neatly arranged in groups forming distinct stripes on the leaf surface. Pustules can be either scattered or clustered on the leaves and leaf sheaths of infected plants. Rust-resistant varieties should be cultivated. Spray of *neem* seed kernel extract immediately after the appearance of symptoms is promising in minimizing number of pustules/leaf.



**Loose smut (*Ustilago tritici*):**

Loose smut symptoms do not become apparent until ear emergence. At this time, ears of infected plants emerge earlier, have a darker colour and are slightly taller than the ears of healthy plants. On infected ears, the florets are full of a mass of black spores.



Beed kernel

These spores are initially held by a thin membrane, which soon ruptures releasing spores. Eventually all that remains of the head is the bare stalk. Grow loose smut resistant varieties. Use disease free seed. In organic systems, hot water seed treatment can be

used to rid infected seed of the loose smut fungus. Solar heat treatment of infected seed is highly valuable in the hot summer areas of the plains to make seed disease free.

### Insect management

**Aphid (*Rhopalosiphum maidis*):** It is the most important insect of wheat crop. Sugary secretion of honey dew is noticed after infestation. There are many natural enemies available for aphids in the field itself. Coccinellids and syrphid grubs prey upon them. Spraying of 250 litres of concentrate *neemashtra* solution per hectare can control aphids. Adopting proper spacing and application of recommended level of organic manure are advised for the management of aphids.



*Dashparni* extract is useful to manage all kind of insect-pests. 5-6 litres of *dashparni* extract is diluted in 250 litres of water for spraying one ha wheat crop.

### Harvesting, threshing and storage

Yellow and dry straw is an important visual indicator for readiness to harvest wheat crop. Shredding, breaking of spikes and shattering grains are common if the standing crop is allowed to over ripe. The most suitable stage of harvesting is when the grains become hard and contain 20-25% moisture. After harvesting, it should be sun dried and threshed with a pair of bullock or by using threshers. After threshing, wheat grain should be dried properly to bring down grain moisture less than 12% before storage. Sun drying on black plastics or coloured tarpaulin is 15-20% faster than drying on mud floor. Grains/seeds should be stored in improved metallic bins available in markets.

#### For further details, contact us

##### The Director

ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan,  
Almora-263 601 (Uttarakhand)  
Tel No. (05962) 230208, Fax (05962) 231439  
Email: director.vpkas@icar.gov.in, vpkas@nic.in  
Website: <http://www.vpkas.icar.gov.in/>

#### Script

Dibakar Mahanta, K.K. Mishra, J. Stanley  
J.K. Bisht and L. Kant

#### Printing assistance

PME Cell

Published by Director, ICAR-VPKAS, Almora-263601 (Uttarakhand) and Printed at M/s M.S. Printers, C-108/1 Naraina Industrial Area, Phase-II, New Delhi, Tel. No. +91-11-45104606, (M)+91-7838075335

## Organic Farming of Wheat under Rainfed Condition in Hills



Published under Institute NEH programme



ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan,  
Almora-263 601 (Uttarakhand)  
2021

Toll free Krishak helpline - 1800 180 2311  
Contact Timings - Every working day (10 AM to 5 PM)



**Wheat** is the most important food grain crop of *rabi* season in the North-Western Himalayas (NWH) as well as in Uttarakhand. It is cultivated in an area of 1.39 and 0.21 million ha in the NWH and the hills of Uttarakhand, respectively. The productivity of wheat in NWH and hills of Uttarakhand is 15.5 and 15.4 q/ha, respectively, which is very less compared to the national average of 35.0 q/ha. The cause of the low yield is that most of the cultivated area of wheat in the NWH is under rainfed situation. Further, the farmers hold very small operational land holdings and lands are highly fragmented and soils are shallow. However, the yield of wheat under rainfed condition can be enhanced by improving water holding capacity, temperature moderation and soil health with following proper organic management.

### Climate

The rainfed wheat is grown in mountains of Himalayas on small terraces during winter season. In higher hills, where winter is severe, the wheat crop is cultivated during summer between May and September. Temperature is relatively cool throughout the crop season for which the crop has longer vegetative period and growing season. Drought during the crop season is very common. Further, damage due to frost is frequent. The organic management of crop moderates the soil temperature up to 1-2°C during the peak winter. It helps the wheat crop for better growth and higher grain yield.

### Soil

Soils with loam to clay loam texture and moderate water holding capacity are ideal for wheat cultivation. Soils should be neutral in reaction. Soil having higher organic carbon is preferred.

### Field preparation and level of organic manure

Wheat requires well pulverised soil free from clods. Optimum germination is the most important factor for higher yield under rainfed situation. Adequate moisture in the seeding zone should be ensured by conserving soil moisture from monsoon rainfall. Field preparation should be done with great care as moisture conservation is dependent on it. Application of mulch to the previous standing crop as monsoon recedes conserve sufficient moisture in the soil surface for sowing of rainfed wheat. It also maintains more friable soil structure, favourable soil hydrothermal regime for greater root growth and early establishment of the crop, enhances nutrient availability, physico-chemical properties and finally, produces higher grain yield of wheat. In these areas, ploughing should be done in the evening time and furrows should be kept open whole night to absorb some moisture from dew. Planking should be done after each ploughing early in the morning.

Application of 30 tons per hectare farmyard manure (6 quintals per *nali*) is advised to harvest the economic optimum wheat grain yield (highest net profit), although the response is up to 45 tons per hectare (9 quintals per *nali*) (more grain yield with low net

profit). 2 quintal of FYM/ha (4 kg FYM/*nali*) mixed with 50 g *Trichoderma harzianum* and 200 g *Bacillus cereus* strain WGPSB-2 powder and incorporated into the soil during field preparation to avoid fungal disease and white grub infestation, respectively. Application of 250 kg per hectare of *ghanjeevamrit* (prepared from indigenous cow dung, jaggery, pulse flour, indigenous cow urine and undisturbed soil from forest) enhances the soil health and yield.

### High yielding variety suitable for organic farming

VPKAS, Almora has developed a number of varieties suitable for rainfed organic farming.

Sowing condition	Variety
Low and medium hills (400-1700 m above mean sea level)	
Early sowing	VL <i>Gehun</i> 829
Timely sowing	VL <i>Gehun</i> 802
	VL <i>Gehun</i> 804
	VL <i>Gehun</i> 967
	VL <i>Gehun</i> 2015
Late sowing	VL <i>Gehun</i> 892
High hills (> 1700 m above mean sea level)	
Timely sowing	VL <i>Gehun</i> 832

Among the above mentioned varieties, VL *Gehun* 829, and VL *Gehun* 892 have tremendous potential under rainfed organic situation in hills. The performance of VL 829 is far superior under timely sown rainfed organic condition also, although it has been released for early sowing.

### Sowing Time

Temperature of approximately 20-22°C during sowing supports rapid germination for a vigorous crop stand. At temperatures considerably above the optimum, the grains germinate irregularly and the embryo frequently dies. At temperatures as high as 35°C, the endosperm may undergo decomposition due to the activities of soil microorganisms. The sowing time for different production condition of northern hills is mentioned in below.

#### Low and medium hills (400-1700 m above mean sea level)

Early sowing : Last week of September to first week of October

Timely sowing : October 5 to 20

Late sowing : After October month

#### High hills (> 1700 m above mean sea level)

Timely sowing : Last week of September to first week of October

Optimum germination is one of the most important factors for higher yield under rainfed situation. Hence, sowing must be completed as early as possible with sufficient residual moisture.

### Seed rate and spacing

A seed rate of 100-125 kg per hectare is sufficient under favourable residual soil moisture for timely sown condition. The

seed rate should be increased to 125-140 kg per hectare under late sown condition and insufficient residual soil moisture.

For timely sown crop, a spacing of 17.5 cm between rows is recommended for higher yield. When sowing is delayed, a closer spacing of 15 cm should be adopted.

### Seed treatment

The seed inoculation with *Azotobacter*, phosphate solubilizing bacteria (PSB) (*Pseudomonas fragii*) and plant growth promoting rhizo-bacteria (PGPR) (PGERS17) each with 5-10 g/kg of seed; and soil application of arbuscular mycorrhiza (*Glomus fasciculatum*) @ 5 kg/ha (100 g/*nali*) enhance the grain yield. The *beejamrit* (prepared from indigenous cow dung, lime, undisturbed soils from forest and indigenous cow urine) can also be used as seed treatment. The seeds (2 kg per *nali*) should be made wet by sprinkling water 2-3 hours before sowing. Then, seeds are inoculated with *Azotobacter*, PSB, PGPR and *beejamrit*; and kept on newspaper for drying in shadow. It is better to sow seeds of inoculated wheat during morning hours. The inoculated seed should neither be dried nor sown during bright sunshine to check the loss of moisture harvested from dew of the previous night.

### Depth of sowing

The coleoptile length of high yielding dwarf varieties is about 5 cm. Therefore, seed should not be covered by more than 5 cm deep below the soil to ensure uniform and good germination, where sufficient soil moisture is available. Seed placed deeper results in reduction in emergence leading to poor crop stand, whereas seeds placed in near surface are unable to acquire enough moisture for germination. For late sown crop, seeds should be sown shallow (about 4 cm deep), as deep sowing delays the emergence of seedlings by 2-3 days and heading by 5-6 days.

### 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. Broadcasting is a primitive, but widely prevailing method of wheat sowing in the NWH. However, all the seeds broadcast do not get proper contact with moist soil. Secondly some seeds are left uncovered and are eaten away by birds. This results in poor and uneven germination. To overcome these impediments, 25% higher seed rate is recommended for broadcasting. But, this method of sowing should not be encouraged. Drilling of seed with the help of fertilizer-cum-seed drill is the best method of sowing. The seed drill drops the seed at an optimum depth and spacing and results in uniform germination and regular plant stand. *Desi* plough can also be used to open furrows at 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.