

CONFIDENTIAL

From: Dr. P.C. Raheja, M.Sc., Ph.D., D.Sc.,
Indian Agricultural Research Institute

D.O. No. 11544

New Delhi, the 3rd October, 1955

My dear Dr. Pal,

I very much regret that I did not send this file to you. The typed copy is enclosed so that you may be able to correct it while out on tour. I am retaining the manuscript as a safeguard against any mishap. All the points have been given in pencil. Any supplementary information required will be given on your kind return from tour.

With best regards,

Yours sincerely,

P.C. Raheja
3/10
(P.C. RAHEJA)

Dr. B.P. Pal, M.Sc., Ph.D. (Cantab), FLS, FNI.,
Director, I.A.R.I., New Delhi,
C/O

Dr. K.L. Narasimhan,
Director of Agriculture,
Secretariat Buildings, GANTOK, SIKKIM.

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From: Dr. P.C. Raheja, M.Sc., Ph.D., D.Sc.,
Indian Agricultural Research Institute

D.O. No. 11549

New Delhi, the 3rd October, 1955

My dear Dr. Pal,

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Director, I.A.R.I., New Delhi,
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Dr. K.L. Narasimhan,
Director of Agriculture,
Secretariat Buildings, GANTOK, SIKKIM.

*I am extremely sorry you did not get the other
copy. The original with slightly modified notes is
put up, please*

P.C. Raheja
12/10/55

// The method of preparing the seed bed varies with soil type, previous crop and whether irrigation is available. In the preceding have fallow the land is opened up by Cross ploughing in the summer season. The opening of land during the dry summer months kills weeds, exposes hibernating insects and dries off parasitic fungi & in consequence results in higher yield. During monsoon it is as after cultivated as season permits to ~~remain~~ ^{cultivation} suppress weed growth. After the monsoon 5 or 6 ^{cultivation} ploughings with Country plough, (one given, usually followed by beaming to conserve moisture) in black cotton soil, a bladed harrow (bhakar) is used instead of the Country plough, for preparing the land. This is done in April-May & again in September-October after the rains and before wheat sowing. //

WHEAT

when it is cultivated in about 7000 years

General

Wheat, the staff of life for millions all over the world, is equalled only by rice as the most important cereal crop. In India, it is grown on an area of about 24,000,000 acres, & is surpassed in acreage by rice and by the millets. Its cultivation extends from the northern limits to peninsular India, and from the western areas to Assam in the east; it occupies 76 per cent of the area under winter cereals & 12 per cent of the area under all cereals; one-seventh of the total production of cereals is constituted by wheat grain. It is particularly important in the northern states where it is the chief source of income of the farmers. ^{It is also the highest priced winter crop among the major cereals, & forms the basis of food value.}

Triticum vulgare is the most important species, followed by T. durum which is widely grown in parts of central & peninsular India. T. dicoccum is grown to a limited extent in the Nilgiri Hills (S. India) & in the mountainous areas of the T. Nilgiri. T. sphaerococcum occurs as traces in

major wheat growing states
Punjab
Haryana
U.P.
Bihar
West Bengal
Assam
Sikkim
Nepal
Tibet

of Hydrabad, Bombay, Mysore & Madras

Climate wheat is adapted to a wide variety of climatic conditions but the best wheat-growing region is the north India plain with a growing period of 5-6 months and a cool winter. Frost at flowering time is also a factor adversely affecting production & drought or areas. The quality of grain produced in the drier areas is generally superior to that from humid or irrigated parts.

Soil Although wheat can grow on almost all types of soil, it prefers well-drained loamy soils. The three main soil types are: the Gangetic alluvium of Uttar Pradesh & Bihar, the black soil tract of Peninsular India comprising Deccan trap & basaltic alluvium of Maharashtra & parts of Bombay. The black soil tract region is irrigated which has been highly fertile. wheat does best in fields where the soil is well-drained & irrigation is available.

Vidhya Prasad
Sachin & Rajesh

Seed-bed The wheat seedbed should have a fine mellow texture, be free from weeds and stubbles, and should have sufficient moisture to ensure good, uniform germination. The method of preparing the seed-bed varies with the soil conditions & whether irrigation is available. Preparation of land for wheat cultivation should be started as early as possible; opening of land during the dry season/moist uniform soil conditions & results in higher yield & better quality grain. Ploughing done after the monsoon rains should be followed by planking or beaming. In black cotton soil, a beamed hoe (bhakar) is used instead of the plough, for preparing the land; this is done in April-May & again in September-October after the rains & before sowing.

5-6 ploughing done in the early hours of the morning

- (A) Seed
- (B) Time of sowing
- (C) Manuring
- (D) Irrigation & other sowing practices
- (E) Harvesting
- (F) Selection of varieties
- (G) Varieties recommended
- (H) Standards

Sowing
seed

harvesting other aspects

for typescript

Manuring ∴ Wheat, in India, responds to fertilizers and manures, especially nitrogenous ones, particularly under irrigated condition. Wheat ~~assimilates~~ ^{assimilates} easily nitrate and ammoniacal nitrogen. On most soils ammonium sulphate has proved very effective fertilizer. In black soil tracts, under irrigated condition 30 lbs of nitrogen and under unirrigated conditions 15 lbs of nitrogen is enough. In the Indo-Gangetic alluvium the dose ^{applied} of 15 lbs of nitrogen, but after sorghum or pear millet it is 40 lbs nitrogen. It may be applied drilled or broadcast; both are equally effective. Addition of phosphate also enhances yield considerably and its application to wheat, under irrigation in particular, in ^{Hyderabad,} the Punjab, Bihar, Madhya Bharat, Madhya Pradesh, Bombay, Uttar Pradesh and Rajasthan is especially useful. A ratio of 2:1 or 1:1 of nitrogen and phosphate is optimum. Combination of organic manures is very maintaining soil fertility and giving high output of the crop. Oil cakes, where-ever available are given as ^{concentrated} organic manures, but the non-edible ones should be preferred, as the others are required for feeding cattle. Green manuring under conditions of irrigation or assured rainfall is highly beneficial to the wheat crop: addition of superphosphate along with green manure gives marked increase in the yield especially where soils are deficient in phosphate. Guar, Cowpeas and Sun hemp ^{are in common} are ^{used} as green manure crops.

Manuring:

Wheat, in India, responds to nitrogenous fertilizers and manures very well, particularly under irrigated conditions. Nitrogen can be applied to it in any form. However, ammonium sulphate has proved more useful as a fertilizer. In tracts of black soils, under irrigated conditions 15 lbs of nitrogen and under unirrigated conditions 8 lbs of nitrogen is enough. In Indo-Gangetic alluvium the dose is 20-30 lbs. of N. Drilling of fertilizer produces better results than broadcasting. Addition of phosphates also enhances yield considerably and its application to wheat in Madhya Pradesh, Bombay, Madhya Bharat, Punjab and Bihar is specially very useful. A ratio of 1:1 or 1:2 of nitrogen and Phosphate is optimum. Combination of organic manures is very effective in giving the maximum yield and maintaining the soil productivity. Oil-cakes, wherever possible should be preferred as organic manures. Green manuring under irrigated conditions or assured rainfall is highly beneficial to the wheat crop everywhere. Addition of superphosphate along with green manure gives marked increase in the yield specially where soils are deficient in phosphate. Guar, dhaincha, and sunn-hemp can be used as green manure crops.

Seed bed:

The wheat seed bed should have a fine mellow texture, free from weeds and stubbles and should have sufficient moisture to ensure good and uniform germination. The method of preparing seed bed in this country varies with the soil conditions and also whether the crop is irrigated or unirrigated. The preparation of land for wheat cultivation should be started as early as possible. The opening of land during summer months improves the soil condition and it results in not only higher yield, but improves the quality of grain also. Usually 5-6 ploughings should be enough. These operations should be done in early hours of morning to conserve soil

especially nitrogenous ones,

30 lbs.

15

UP etc?

but the non-soluble ones should be prepared as required for heavy cattle.

Structure

WHEAT

Wheat is the principal food crop of India next only to rice. Every year a very large acreage is being put under it and its cultivation extends from the northern hills to the peninsular India one side and to the Assam on the other side. At present its acreage is 24 million acres and occupies 76 per cent of the area under rabi cereal and 12 per cent of the area under all the cereals. One-seventh of the total production of the cereals in the country, is constituted by wheat grains. It is particularly important crop in the northern states where it is chief source of income to the farmers. It is very important from the point of view of food value also and is increasingly finding favour with rice and millet eating people. Among the cereals, it has got the highest protein content and as such it is the chief source of protein to the people taking it.

Climate:

Wheat is adapted to wide variety of climatic conditions. However, best wheat producing regions are in the north where growing period is about 6 months and winter is cool. Abnormal weather conditions affect both acreage and production of wheat to a considerable extent.

Soil:

Although, wheat can grow almost on all types of soils, it does best on well-drained loamy soils. The wheat growing area in India consists of three main divisions, namely, Gangetic alluvium of Uttar Pradesh and Bihar, Indus alluvium of East Panjab and black soil tract of peninsular India comprising Central India, Madhya Pradesh, Hyderabad and parts of Bombay. In Indo-Gangetic alluvium - the most important wheat sowing tract, 30-50 per cent of the total area under wheat has irrigation facilities while most of the wheat in peninsular India is grown under unirrigated conditions. Wheat does best on the fields where productivity has been properly maintained and where the irrigation facilities are available.

Manuring:

Wheat in India responds to nitrogenous fertilizers and manures very well, particularly under irrigated conditions. Combination of organic and in-organic manures is very beneficial in giving the maximum yield and maintaining the soil productivity. Green manuring is very beneficial for irrigated wheat. Addition of superphosphate along with green manures, shows marked increase in yield. The crops of guar, dhaincha and sunhemp have proved very successful as green manures. Application of phosphate has been found very useful in Madhya Pradesh, Bombay, Madhya Pradesh Panjab and Bihar. A ratio of 1 : 1 or 1 : 2 of N and P₂O₅ is optimum. Excessive use of nitrogenous manures should be avoided.

Ex

Seed bed:

The wheat seed bed should have a fine mellow texture, free from weeds and stubbles and should have sufficient moisture to ensure good and uniform germination. The method of preparing seed bed in this country varies with the soil condition and also whether the crop is irrigated or unirrigated. The preparation of the land for wheat cultivation should be started as early as possible. The opening of land during summer months improves the soil condition and it results in not only higher yields, but improves the quality of grain also. Usually 5-6 ploughings should be enough. These operations should be done in early hours of morning to

conserve soil moisture. Ploughings after the monsoons should always be followed by planking or beaming.

In the black cotton soil, instead of plough, 'bhakar' is used for preparing the land. The bhakar may be used in April and May and then again in September after the monsoons and in October before sowing.

Species grown commercially in India:-

Three species of wheat namely, T. vulgare, T. durum and T. dicoccum are commercially cultivated in India.

T. Vulgare:

This is by far the most important species of wheat cultivated in India. It is grown extensively both under irrigated and un-irrigated conditions. Almost whole of the wheat area in the States of Panjab, U.P., Bihar and Rajasthan is under this species. The flour made from this is consumed for making chapaties. Most of the popular improved wheat varieties belong to this species.

T. Durum:

These are also known as macaroni wheats. These are in great demand for the manufacture of Samolina (Sooji) and Vermicelli (Sewain) due to the higher content of the gluten. These are extensively grown in Madhya Pradesh, Madhya Bharat, Bombay and in Bundhelkhand area of U.P.

T. Dicoccum:

This wheat has got very hard grains. It is cultivated on a very small scale in India. The largest proportion of Emmer is grown as an irrigated crop in Bombay and its cultivation is also practiced to a small extent only, in Hyderabad, Mysore and Madras.

Selection of varieties:

Selection of a proper variety for a particular area to suit its various requirements is very important for obtaining good yields and the maximum profit. The variety selected, as far as possible, should be resistant to the diseases prevalent. In the areas of short duration, early varieties should be grown and while in the areas of long duration, varieties with the prolonged maturity should be sown. Seeds selected for sowing should be free from seed borne diseases, seeds of weeds, other varieties and broken seeds. Seeds besides being ^{well-timed} plump, should also have high germination percentage. The varieties recommended for different States are given in the following table:-

<u>State:</u>	<u>Varieties recommended:</u>
U.P.	N.P.710, Kanpur 13 (for plains), C.591 N.P.770 and N.P.809 (for hills only)
Panjab	N.P.718 C.591 (for timely sowing irrigated conditions) C.228 (for late sowings " ") C.250 (for humid areas) C.281 (for areas with short growing period) 9D (for 'barani' areas) C.253 (for hilly tracts) & C.285 (for Lahaul valley)
Bihar	⁷⁵⁸ N.P.761 and B.R.319
Orissa	⁷³⁷ N.P.761 and N.P.718
M.P.	N.P.710, Hyb.5, Hy.18, Hy.11, Hy.25 and Hy.5
M.B.	N.P.710 and N.P.718

(Contd.)

Wheat is
beginning
?

write a

Kand
Rohat
Lagan
NP 718?

NP 52

with model
W. Nepal
Hyderabad?

State: Varieties recommended:

Rajasthan	N.P.718 and N.P.758
Saurashtra	N.P.710 and N.P.715 <i>(Original)</i>
Bombay	N.P.710, Kenphad yellow 28, Kenphad yellow 25, Kenphad red 34, Niphad-4, Vijay and Jay.
Delhi	N.P.718
Himachal Pradesh	N.P.770, N.P.809 and Ridley.

Time of sowing:

The timely sowing of wheat is ~~also~~ very important. Late sowings result in poor quality and low yields. Sowing of wheat in India starts ~~by the beginning of October~~ and goes upto December in different States depending upon climate and local conditions. The sowing dates for main wheat growing States are as follows:-

Bihar	October-November	<i>omit</i>
Bombay	October-November	<i>omit</i>
Madhya Pradesh	October-November	<i>omit</i>
Panjab	October-November	<i>omit</i>
U.P.	October - November	
Madhya Bharat	October	

Late sowings in the Punjab & U.P. continue upto mid-December.

Seed rate:

The seed rate varies according to the local conditions, soils and implements used for sowing. In general, the seed rate of 80 lbs. per acre is recommended. Short growing period, lower fertility, poor irrigation facilities, delayed sowing tend to increase the seed rate while the more favourable conditions at the sowing time, the use of improved implements for sowing, tend to decrease the seed rate. However, the optimum seed rate for different States is as follows:-

Bihar	60 lbs.
Bombay	40-50 lbs.
Madhya Pradesh	60-80 lbs.
U.P.	60-80 lbs.
Panjab	50-70 60-80 lbs.
Hyderabad	40 lbs.
Madhya Bharat	60-80 lbs.
Delhi	80 lbs.
Vindhya Pradesh.	80 lbs.

Seedin*:

The wheat is sown in three ways, *seed* broadcast, dibbling or drilling.

- (i) broad casting,
- (ii) dibbling, and
- (iii) drilling.

Dibbling and drilling are preferable to broad-casting, because these ensure the sowing at proper depth which results in better germination and better stand. Seed-rate required is also less with drills and sowing in line has the added advantage of ~~ease of~~ hoeing, etc. The depth of sowing is also important for proper germination. Generally speaking, deeper sowings are necessary in rough, dry and light soils while comparatively shallower sowings are desirable on moist or heavy soils. The distance from row to row in general, should be 9", although it may vary from place to place according to local conditions.

beginning of Oct.
as early as Sept in some areas
April
omit?

Hand with the dibbling method
dribbling (Kera)

dribbling (Kera)
uniform

to staminy

does

|| After $1\frac{1}{2}$ to 2 months of the sowing of the crop one or two hoeings, depending upon weediness of the field, are given to remove weeds. In irrigated areas, the ~~1st~~ first hoeing, is given after the irrigation and a subsequent one is done after the 2nd irrigation. These may be hand hoeings or with a small bladed khakar (hoe.). These prove very beneficial. ||

Irrigation and after sowing operations:

earwig

^{the} first irrigation normally should be given one month after sowing. In very light soils, it may have to be given a little earlier. Irrigation at the time of anthesis is also very essential. Excessive irrigations should be avoided, as it leads to the production of mottled grains which have poor quality. // After the seed has been sown, very little is done in the way of hoeing and cultivation especially when the wheat is sown under dry farming conditions. One hoeing after 1½-2 months of the sowing of crop will be very beneficial.

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 & trends
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Harvesting:

The wheat should be harvested when it is dead ripe. At this stage, the straw becomes golden yellow and brittle and the grains hard. The time of harvesting is different in the various wheat growing areas depending upon the temperature. State-wise these are as follows:-

Bihar	Feb-March-April	Dr
Bombay	March	
Madhya Pradesh	February-March	
Panjab	April-May	April
U.P.	March-May	

regions of the
 U.P., & Kashmir

In the mountainous regions, sowing is even in June or early July.

disinfected by
 heating or
 fumigation

After threshing and winnowing, the grains should be thoroughly graded and dried before storing. Storage rooms should be thoroughly dry and capable of remaining so during monsoons. For long term storage, concrete pits are most economical.

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