PART II
CHAPTER IV

CHANGES IN LANDUSE IN GANGLYAMUNA DOAB
1911 to 1961

Ganga-Yamuna Doab is mainly an agricultural region and belongs to a most fertile and thickly populated part of Uttar Pradesh, where about 10 million acres out of the total area of about 14.2 million acres or about 72 per cent of the land is under cultivation. An attempt has therefore been made to study the landuse and the changes that have taken place during a period of fifty years (1911 to 1961).

With the increase in population and urbanization, the pressure on agricultural land has increased substantially. This has resulted in an encroachment of built over area on cultivated lands in the neighbourhood of towns and the preservation of good agricultural lands has become one of the serious problems of landuse planning. The cropping pattern has also been changing with the increased facilities of irrigation availability of manures and fertilizers.

1. Figures have been taken from unpublished record of general landuse (Milan Khasra) of 1961. Board of Revenue Land Record Section, Lucknow.
In this study of landuse changes in the Ganga-Yamuna Doab over a period of fifty years, tehsil has been taken as the unit of study and the changes have been studied for each decade beginning with the year 1911 up to the year 1961.

There are two main agricultural seasons in the region i.e., the kharif or the season of summer crops and the rabi or the season of the winter crops. These seasons are named after the sowing period. The sowing period of kharif crops commences generally with the advent of the monsoon rains, sometime in June.

The rabi crops are usually sown during the beginning of winters in the later half of October and are harvested during the months of April and early May.

The percentage of four classes of landuse namely 1) Land not available for cultivation; 2) other unculturable land, excluding fallow; 3) Fallow lands; and 4) Net sown area have been calculated in relation to the total area of each tehsil.

**LAND NOT AVAILABLE FOR CULTIVATION**

The land under this class of landuse comprises those lands which are put to non agricultural uses, such as settlement, burial grounds, playgrounds, roads,
railways, embankments etc., and waste lands known as "wast".

During 1911 the total area under 'land not available for cultivation' amounted to about 2,471,261 acres. During 1921 the area increased to 2,580,936 and by 1931 the total area under this category reached 2,619,669 acres.

However by 1941 the area under this category again reached almost the same level as in 1911 i.e., to 2,414,643 acres. The next decade saw a further decline and the area dropped to 2,192,878 acres. However by 1961 there was a slight increase which pushed the total to 2,223,387 acres. It may thus be seen that during the five decades ending in 1961, the area under 'land not available for cultivation' has fluctuated between 2.2 and 2.4 million acres. During the decade ending 1961, the area under water bodies, construction works and cemeteries increased substantially, while the areas under the 'waste land' declined. This clearly reflects the pressure of population on the land.

An attempt has been made to examine the regional distribution of the magnitude of change over a period of fifty years in this category of land.
The changes have been grouped under four categories.

(i) Areas where the changes has been very small in amount (less than 10 per cent); (ii) where it is small (with 10 to 20 per cent); (iii) where it is large (with 20 to 30 per cent); (iv) where it is very large (with 30 to 40 per cent).

Areas with Very Small Change:

During 1911 twelve tehsils were under this category. The Fig. 63 a indicates that the main concentration is in the Upper Doab as well as in the lower Doab districts. The study further reveals that there did not occur any major change in the areal distribution of this category of land in the next three succeeding decades (1921, 1931 and 1941). However in the last two decades (1951 and 1961) a marginal increase in the area under this category had been recorded in Musaffarnagar, Aligarh and Etah districts.(Figs. 64, b and c)

There are some tehsils where in fact no change in acreage has taken place and they can be considered as 'very stable', and those where change has taken place once or twice and they can be termed as 'moderately stable'; those where change has taken place many times (three times)
they are termed as 'unstable' and finally those where acreage changes occur in either four or five decennials are termed as 'very unstable'.

There are four tehsils which are very stable, where the land under this category remain the same for all the decades namely Mawana, Iglas, Sadabad and Etah in the Meerut, Aligarh, Mathura and Etah districts respectively. There are six tehsils which are moderately stable, and these are: Deoband, Budhana, Sardhana, Bulandshahr Sadar, Mat and Kasganj, belonging to Saharanpur, Mathura and Etah districts respectively.

There are some tehsils which are unstable and area under this category 'Land not available for cultivation', varies many times during the fifty years span. These tehsils are Hapur (Meerut district); Khurja (Bulandshahr district) and Aliganj (Etah district). There are five tehsils namely Saharanpur Sadar (Saharanpur district) Musaffarnagar Sadar (Musaffarnagar district) Anupshahr (Bulandshahr district), and Etimadpur (Agra district) which are very unstable and the acreage varies from decade to decade.

Areas with Small Proportion of Land not Available for Cultivation (10 to 20 per cent) Land:

It may be seen from Fig. 63a that during 1911 seventeen tehsils were under this category. The area
under this category is highly localized. This category however occupies a considerable area between Saharanpur in the north and Farrukhabad in the south of the region. This tract comprises about five districts, where this category occurs in two tehsils of Saharanpur, three of Musaffarnagar, four of Meerut, three each of Bulandshahr and Aligarh districts.

Another area of minor concentration occurs in Etah, Hathura and Farrukhabad districts.

The areal distribution as revealed in the Fig. 67b clearly indicates the increase of acreage in this category. A few tehsils were added during 1921 and the main areas of expansion were in Farrukhabad, Kanpur and Allahabad districts. The total number of tehsils thus came out to twentyfour. Slight change in the distributional pattern of this category was registered during 1921-31. During this decade twentyone tehsils were under this category.

The decade 1931-41 is marked by a considerable expansion, specially in Musaffarnagar, Aligarh and Allahabad districts. On the whole twentysix tehsils fall in this category. No substantial change in the areal distribution under this category had occurred during 1941-51 decade. A notable change in the
distributional pattern in the last decade; 1951–61 however had occurred and a considerable area had been further added, where in thirtyfour tehsils occupied this category. The Fig. 64e indicates one important fact that unlike the preceding trend the areal extension during this year occurred in the southern part of the region.

As in the previous category, here in this category there are several tehsils which are prone to change and some not so prone to change. Eleven tehsils emerged as very stable. Most of the eleven very stable tehsils lie in the districts of Meerut, Farrukhabad, Aligarh and Bulandshahr. There are seven unstable tehsils and they lie in the four districts of Bulandshahr, Agra, Etah, and Farrukhabad. The very unstable areas constituting about seventeen tehsils occur mainly in the districts of Mainpuri, Fatehpur and Kanpur.

Areas with Large Proportion of Land not Available for Cultivation (20 to 30 percent)

Considering the change, under above percentage category, it will be seen that in all there were nineteen tehsils occupying this category during 1911. The largest concentration occurred in the lower Doab districts of Fatehpur and Kanpur, and in middle Doab, mainly in
Farrukhabad and Mainpuri districts. There were a few tehsils in this category in Aligarh and Etah districts also.

The distributional pattern remained more or less the same until 1951. However, during 1961 a large number of tehsils had moved out of this category. The total number of the tehsils under this category is reduced to eleven. The most affected parts in this regard were the districts of Kanpur and Allahabad in the lower Doab.

Areas with Very Large Proportion of Land in the Category of Land "not Available for Cultivation" (30 to 40 per cent)

The areal extent of the land under this category is extremely limited and seldom showed any change during the entire period under study. The boundary of these lands as recorded in 1911 elides to the southern parts of the region. All tehsils belonging to this category thus remained stable, and very large proportion of land throughout the fifty year period were not available for cultivation.

Other Unculturable Lands (Excluding Fallow)

Land which is classified as "other unculturable lands" is an important category of land use. This category
excludes fallow lands and consists of groves, forests, lands pasture land and unused land. This class of landuse occupied 1,184,438 acres in 1911. It was reduced to 996,399 acres during 1921. But during 1931, it rose to about 1,763,471 acres. After 1931, as the figures indicate a declining trend had been registered during subsequent decades amounting to 4,046,466 acres/1,555,499 acres in 1961.

The unculturable land does not exceed 30 per cent anywhere in this region throughout the period under study, and has been grouped into the following three categories:

(1) Areas with very small proportion of "other unculturable land" (less than 10 per cent)
(2) Areas with small proportion of land (10 to 20 per cent)
(3) Areas with large proportion of such land (20 to 30 per cent)

(1) **Areas with Very Small Proportion of "Other Unculturable Lands" (less than 10 per cent)**

The year 1911 is marked by an extensive distribution of the above category. As many as forty-two tehsils out of the fifty seven were occupied by this category. Except Farrukhabad and Etawah districts, and a few tehsils in
GANGA-YAMUNA DOAB
CULTURABLE WASTE
(EXCLUDING FALLOW)
1911-31

SOURCE: UNPUBLISHED RECORD BOARD
OF REVENUE (LAND RECORD
SECTION) LUCKNOW.

Fig.65
GANGA-YAMUNA DOAB
CULTURABLE WASTE
(EXCLUDING FALLOW)
1941-61

SOURCE: UNPUBLISHED RECORD
BOARD OF REVENUE (LAND RECORD SECTION) LUCKNOW.

Fig. 66
other districts almost every tehsil had land under this category. This means that small proportion (less than 10 per cent) of unculturable lands had a fairly universal distribution in the area under study (Fig. 65a).

More or less similar condition, with minor change existed during 1921. During this decennial five more tehsils were added to this category and the total increased from fortytwo to fortyseven. (Fig. 65b)

A substantial change during 1931 and 1941 had however been recorded. The number of tehsils during these decades had been reduced to twentyseven in the former and twentytwo in the later decennial. The areas where there was a marked contraction of this category of land lie in the districts of Muzaffarnagar and Bulandshahr in Upper Doab, and Etah, Mainpuri and Farrukhabad in the middle Doab. In the lower Doab this category had been completely eliminated. (Figs. 65c, 66a)

During 1951 and 1961, a slight increase in the areas under this category had been recorded and more than thirty tehsils were covered by this category. (Figs. 66b, c)

Taking into consideration the changes of this category, it is found that the area did not fluctuate in seventeen tehsils and they remained very stable these tehsils are largely located in Saharanpur, Aligarh and
some adjoining districts like Mathura and Agra. There are sixteen tehsils which remained moderately stable, covering Bulandshahr, Meerut and Kanpur districts. There are nine tehsils which are unstable they are widely distributed all over the region. While there are eight tehsils, particularly located in the lower Doab districts which are very unstable.

(2) Areas with Small Proportion of "Other Unculturable Lands" (10 to 20 per cent)

This category covered a very small area during 1911. It will be seen from Fig.65a that only thirteen very widely distributed tehsils were under this category.

In the next decade this category dwindled, and only eight tehsils remained in this category.

A phenomenal increase in the areas under this category, however had been registered during two successive decennials of 1931 and 1941. There were large concentrations of these areas in the lower parts of the Doab. The total number of tehsils occupying this category were twentyseven and twentynine in the respective decennials (Figs.65a and 66a)

In the succeeding two decades 1951 and 1961 the number of tehsils had once again registered a fall to only seventeen out of the fiftyseven tehsils. (Fig.66b,c)
It is obvious from the above study that this category has been dwindling and expanding appreciably and during the fifty year period there is only one tehsil— Sikandrabad in the Bulandshahr district which was very stable. Thirteen tehsils mostly located in the southern parts of the middle Doab were moderately stable. Seven tehsils were unstable and these are widely distributed all over the region. Very unstable tehsils are largely concentrated in Etawah, Kanpur and Allahabad districts in lower Doab region. The total number of such tehsils are nine.

3. Areas with Large Proportion of other Unculturable Lands (20 to 30 per cent)

This category in fact does not have any sizable distribution to merit a detailed study.

FALLOW LANDS

The term fallow land is applied to the lands which are not under crops at the time of reporting but which had been seen in the recent past. Generally fallow lands are divided into two classes— old fallow lands which comprise those lands that have been left unutilized for more than five years. The new fallow
lands include those lands which were not sown at the time of crop reporting, but were sown one or two years before or they were left fallow either in one season or for one complete year to replenish their fertility.

As regard the changing trend in the fallow lands in the Ganges-Yamuna Doab, the area during 1911 was 1,301,868 acres. A decade later, that is in 1921 it rose to 1,650,694 acres. But in the following three successive decades i.e., in 1931, 1941 and 1951, the figure declined to 723,177 acres, 483,489 acres and 476,762 acres respectively. However in 1961 the area again increased substantially and was accounted for as 695,699 acres.

The increase in the fallow lands during 1961 was mainly due to the rise in the acreage under sugarcane cultivation particularly in the districts of Upper Doab.

The fallow lands also have been grouped into three categories based on percentage gradings. (1) those with very small proportion of the fallow lands (less than 10 per cent), (2) those with small proportion of above land (10 to 20 per cent), (3) those with large proportion of it (20 to 30 per cent) and (4) those with very large proportion (30 to 40 per cent).
The last category does not exist, unlike the previous two classes of landuse.

**Areas with Very Small Proportion of Fallow Land (less than 10 per cent).**

It will be seen from Figs. 67a and 67b that during the two successive decades of 1911 and 1921 except a few districts mainly in the lower and the upper Doab, almost every part of the region is dominated by this category. In all thirty-four and thirty-one tehsils out of the total of fifty-seven in the region were under this category during the respective decades. Apart from the minor fluctuations no outstanding change had occurred during the following decades.

A large part of the region manifests **very stable** to **moderately stable** trend. About twenty-seven tehsils are **very stable**, while thirty-three show **moderately stable** conditions. And only three tehsils are **unstable**.

Much of the **very stable** areas lie in the districts of Meerut and Bulandshahr in the upper Doab and Aligarh in the middle Doab. The other parts are **moderately stable**.
Areas with Small Proportion of Fallow Lands
(10 to 20 per cent)

The fallow lands under this category remain the same during first two decennials (1911 and 1921). In these decennials a substantial area fall in three districts of Etawah, Kanpur and Fatehpur all lying in lower Doab, as well as in the two districts of Saharanpur and Muzaffarnagar in the upper Doab—Figs. 67a, b, c and Figs. 68a, b, c indicate that no marked change during the fallowing decades was recorded.

The occurrence of this category during all the decades under study suggests that it is either unstable or very unstable in a large majority of tehsils.

Areas with Large Proportion of Fallow Lands
(20 to 30 per cent)

Land under this category is very limited in this region, and shows a nominal change in the areal distribution.

The Figures reveal that at the beginning of the period under study, old fallow was more extensive, as compared to the new fallow. However after sometime, the old fallow was brought under plough specially in sugarcane growing districts of upper Doab.
In 1911 the land under old fallow was recorded as 855,003 acres. During 1961 it was 130,228 acres, which shows a decrease of 724,775 acres. On the other hand the area under other fallows (including largely the new fallow) in 1911 was 446,855 acres and in 1961 it was registered as 565,417 acres that is an increase of 118,616 acres.

**NET SOWN AREA**

The net sown area has been studied in detail and the trends in the regional patterns of distribution and the changes that have been brought about in the above class of land use have been studied.

The net sown area accounted for more than 71 per cent of the total reporting area in 1961.

The net sown area has substantially increased since 1951. The area sown in 1911 accounted for 8,933,789 acres. After a decade i.e., 1921 the net sown area became 8,404,779 acres. In 1931 the total net sown area in the region was reported as 8,708,211 acres. In 1941 it was 8,845,330 acres. In 1951 it was 9,282,273 acres. In 1961, the total area sown accounted for 10,320,504 acres.
Fig. 70

GANGA-YAMUNA DOAB
NET SOWN AREA
1941-61

1961

1951

1941

SOURCE: UNPUBLISHED RECORD BOARD OF REVENUE (LAND RECORD SECTION) LUCKNOW

DATA NOT AVAILABLE

30 40% 50% 60% 70% 80% 90% N.A
For the study of areal change—four groups have been recognized:

(1) Areas with small proportion of net sown area (40 to 50 per cent);
(2) Areas with large proportion of net sown area (50 to 60 per cent);
(3) Areas with very large proportion of net sown area (60 to 70 per cent); and
(4) Areas with extremely large proportion of net sown area (70 to 80 per cent)

Figure 69a reveals that during 1911 the net sown area under this category occupied a very small proportion of land in the region. There were only six tehsils under this category. The areas of concentration of these lands were in the lower Doab. It can be seen clearly that during the next successive decades a gradual decline of this category had taken place. Figures 69b to 70c indicate that in 1921 and 1931 there were five tehsils, while during 1941 and 1951 they were only four and two tehsils respectively. This category was completely eliminated in 1961.

The changes in the category shows that nowhere it was very stable. However three tehsils are moderately stable and eight very unstable.
Areas with Large Proportion of New Sown Area (50 to 60 per cent)

This category was largely concentrated in the middle and lower Doab districts. During 1911-12 twelve tehsils under this category were mainly located in Etah, Mainpuri, Farrukhabad and Kanpur districts. The distributional pattern during the next decennial shows a certain amount of stability with fifteen tehsils under this category. A decade latter the number of tehsils rose to twenty. The distributional pattern during the next succeeding decades did not remain static and the category began to dwindle in extent. As the Figure: 70a,b,c show that during 1941 there were fourteen tehsils, in 1951 five and in 1961 there remained only two tehsils under this category.

The decline of the area under this category as also in the previous category is a clear manifestation of increase in the percentages of the net sown area.

No area in the entire region is marked as very stable. However four tehsils are moderately stable, eight unstable and fourteen tehsils are very unstable for the above category. The moderately stable areas lie in Mainpuri, Etawah, and Kanpur districts. While majority of unstable and very unstable tehsils are located in lower Doab districts.
Fig. 69a shows that in the year 1911 this category occupied fourteen very widely located tehsils, but in 1921 few more tehsils were added to make the total to nineteen tehsils under this category. There was a decrease in the subsequent decades. There were sixteen such tehsils in 1951. An expansion in the area under this category is however well marked in 1961, when the number of tehsils rose to about twenty-one tehsils which were concentrated mainly in lower Doab. It will be noticed that changes occurred a great deal and very stable areas are of rare occurrence,—only one tehsil Roorkee in Saharanpur district is very stable. Seven tehsils are moderately stable, while eight and twenty tehsils are unstable and very unstable respectively.

Areas with Very Large Proportion of Net Sown Area (70 to 80 per cent)

This category remains stable upto 1931 but after this decade, areal expansion took place gradually.

During 1911 and 1921 fifteen tehsils mostly located in the upper and the lower Doab constituted this category. While during 1931 the number of tehsils was reduced to eleven. During 1941 and 1951 the in tehsils this category were mainly located in upper and
lower Doab. In the respective years, twenty and nineteen tehsils constituted this category. Further expansion in area took place in 1961 when twenty-five tehsils occupied this category.

The two adjoining districts of Bulandshahr and Aligarh contain four very stable tehsils which means that net sown area in these districts, throughout the fifty year period, remained between seventy and eighty per cent, while seven were moderately stable and they lie in upper and middle Doab. Ten and sixteen tehsils majority of which are located in upper and lower Doab are unstable and very unstable respectively.

**Areas with Extremely Large Proportion of Net Sown Area (80 to 90 per cent)**

The occurrence of this category is a clear indication of higher order of agricultural efficiency.

Figure 69a indicates that during 1911 only six tehsils, widely distributed in the districts of upper and middle Doab occupied this category. During 1921 and 1931 the number of tehsils reduced to three. During 1941 constituted this category. This category however occupied comparatively larger area during 1951
and 1961, when about nine tehsils mainly located in the upper and middle Doab districts were under this category.

There is only one tehsil Hathras in Aligarh district which is very stable, three tehsils Baghpat (Meerut district), Iglas (Aligarh district), and Sadabad (Mathura district) are moderately stable, two tehsils Deoband (Muzaffarnagar district), Napur (Meerut district) are unstable; and six tehsils—Budhana (Muzaffarnagar district), Sardhana (Meerut district), Bulandshahr Sadar, and Anupshahr (Bulandshahr district), Kat (Kathura district) and Etimadpur (Agra district) are very unstable for the above category.
CHAPTER V

THE CHANGES IN THE RELATIVE RANK OF THE SELECTED CROPS IN THE GANGLA-YAMUNA DOAB

(1911 to 1961)

The relative position of strength among the crops of the Ganga-Yamuna Doab can be assessed by ranking them in each pargana in order of percentage of the total harvested cropland occupied by each crop. The crops occupying first, second and third ranks have been mapped for each pargana for 1911, 1921, 1931, 1941, 1951 and 1961 and the resulting patterns of the distribution have been shown in Figures from 71 to 76.

First Ranking Crops: (their distribution and changes)

Fig. 71 shows the distributional pattern for the crops that ranked first in percentage of the total harvested cropland in the year 1911. It will be seen from Fig. 71 that wheat holds first place in large number of parganas. In eighty out of a total of one hundred and forty-six parganas or roughly sixty per cent of the area, wheat occupies first rank. Thus

1. Pargana stands for the smallest administrative unit of a district.
three districts of upper Doab i.e., Saharanpur, Muzaffarnagar and Meerut, where except three parganas in all the remainingfortysix parganas wheat ranked as a first crop. In district Bulandshahr of upper Doab and all the districts of middle Doab, wheat is no more the dominant crop and there are occasional patches in districts like Etah and Mainpuri where it ranked as first crop.

Another crop which occupied first rank is barley-peas mixed. It occupied first rank in about thirtyfive parganas. The main areas of concentration lie in the districts of Aligarh of middle Doab, and Fatehpur in the lower Doab. Apart from these areas, it was widely distributed along the river Yamuna on the western margin of the region which includes two tehsils of Kataura, one tehsil of Agra and two tehsils of Etawah districts. Some patches of this crop as first rank also occurred in the district of Bulandshahr.

The third important crops that occupied first rank are Bajra-arhar mixed and jowar-arhar mixed. They ranked as first crops in about twenty parganas lying mainly in the districts of Etah, Farrukhabad and Kanpur.
GANGA-YAMUNA DOAB
RANKING OF CROPS
IN PERCENT OF TOTAL HARVESTED CROPS
1921

First Ranking
Second Ranking
Third Ranking

SOURCE - BASED ON UNPUBLISHED DATA
OBTAINED FROM THE BOARD OF
REVENUE LAND RECORD SECTION
LUCKNOW

0 50 100 150 Kilometres

FIG. 72
The picture of the first ranking crops apart from those mentioned above gets blurred as one considers other crops like wheat-gram mixed, maize, rice and gram because neither do they occupy any sizable area nor do they show any distributional pattern.

The existence of fertile land with loamy soil, facilities of irrigation from canals and ordinary wells have enabled wheat to occupy the first position in the district of upper Doab.

The sandy loam in the district of Aligarh, Mathura and Agra replaces wheat by barley-peas mixed.

After a lapse of ten years in the 1921, Fig. 72 the position of first ranking crops as shown in 1911 has not substantially changed. However a small change is noticeable. It will be seen from Fig. 72 that barley-peas mixed began to lose its previous position and occupied twentyseven parganas instead of thirtyfive in 1911. Sugarcane appeared as first rank crop for the first time in Meerut district after replacing wheat.

The year 1931 showed a slight extension of the area under first rank wheat over the past decades. Wheat during this period extended its areas in the districts of Bulandshahr, Aligarh, Etah and Farrukhabad,
and replaced barley-peas mixed and wheat-gram mixed. Thus by 1931 wheat became the first ranking crop in much larger areas in upper and middle Doab, which occupied more than fiftyseven parganas in the region.

Another marked change in this period is the replacement of barley-peas mixed by barley mainly in two districts of Bulandshahr (upper Doab) and Aligarh (middle Doab) as first ranking crop. Since barley is used as the substitute of wheat it eliminated peas and began to occupy land as a single first ranking crop. However the position of barley-peas mixed in the lower Doab remained mostly unchanged.

Fig. 73 shows that in 1931 the area under wheat as first rank crop had increased largely in those areas where barley and barley-peas mixed were occupying first rank i.e., in Bulandshahr and Aligarh districts.

The other first rank crops which had increased their areas are jowar-arhar mixed and bajra-arhar mixed. These crops after replacing first rank crops like barley-peas mixed and wheat extended their areas largely in districts which are located on the western flank of the region. Besides that rice which had emerged as
first rank crop in some parts of lower Doab in 1941, has further increased its area after replacing barley and barley-peas mixed in Fatehpur district of lower Doab. Sugarcane after a gap of two decades again reappeared as first rank crop in at least two parganas of Meerut district of upper Doab. (Fig. 74).

In 1951 a significant change has taken place. Fig. 75 shows that during 1951, sugarcane emerged as first ranking crop in parts of wheat dominated areas of upper Doab. A suitable climate, development in irrigation, availability of cheap labour, improvement in a regular supply of chemical fertilizers and manures, good quality land, and the establishment of sugar factories, resulted in a significant increase in the cultivation of sugarcane and made it a first ranking crop in those areas of upper Doab where formerly wheat dominated. Another important change in the upper Doab in 1951 is that the fodder assumed the position of first ranking crop. It will be seen in Fig. 75 that in the upper Doab, after replacing wheat, fodder has come to occupy the first ranking crop in many parts of upper Doab. The rearing of cattle assumed greater importance firstly because of the food habits of the people who migrated to India from Panjab and Sind after
the partition of the country in 1947, and who take considerable amount of milk and milk products and secondly the rapid growth of the urban centres like Delhi, Meerut, Saharanpur.

The other first ranking crops which had gained their position in this period are wheat-gram mixed, jowar and bajra mixed with arhar and maize in many parts of the region.

In 1961, the new trends which had appeared in the preceding decade further strengthened and the area under sugarcane as first ranking crop further expanded during this period and occupied about thirty parganas, which was more than double the number that existed during the last decade. The main areas of concentration of sugarcane as the first ranking crop existed in the western half of the upper Doab. Barley-peas mixed had also gained some position in the middle and the lower Doab. The other first rank crops however showed no significant change over the last decade.

Second Ranking Crops— their Distribution and Changes:

Unlike the first ranking crops, the distributional pattern of the second ranking crops is not as clear cut and rather fragmentary. At few place, however, there are sizable and compact areas.
It will be seen from Fig. 74 that in 1911, wheat extended over a large part of Bulandshahr (upper Doab) and Aligarh (middle Doab) districts, and then at few places in Etah and Farrukhabad districts (middle Doab). In all there were twenty-four parganas where wheat occupied as second ranking crop during this year. Barley, peas, sugarcane, bajra, jowar and rice occupy negligible second ranking position. Gram, barley, peas mixed, maize, rice, bajra-arhar, mixed, jowar-arhar mixed and fodder emerged as an important second ranking crops in the region. Gram occupies about twenty-one parganas, concentrated largely in the western parts of Saharanpur, Muzaffarnager, Meerut and Bulandshahr districts of upper Doab. Gram also occupied a sizable area as second ranking crops in Kanpur district. Barley peas mixed is another second ranking crop and was concentrated mainly in the district of Bulandshahr (upper Doab) while in other districts belonging to the lower Doab, it occupied in patches. Other important second ranking crops are bajra-arhar mixed and jowar-arhar mixed which occupied about thirty-three parganas of the region. These two mixed crops were largely concentrated in Etah, Mainpuri and Farrukhabad districts of middle Doab, and in Fatehpur district of lower Doab. Fodder was also an important second ranking crop which
extended over a larger part of Saharanpur, Musaffarnagar and Meerut districts of Upper Doab where it occupied seventeen parganas. However, fodder does not occur as the second ranking crop in other parts of the Doab.

Fig. 72 shows the areal distribution of second ranking crops during next point of time i.e., 1921. However barley-peas mixed as a second ranking crop showed a significant increase in area under its cultivation. This increase was recorded in the districts of Kainpuri, Farrukhabad and Etawah in the middle Doab, Kanpur, Fatehpur and Allahabad in lower Doab where it occupied twentysix parganas. In the same year a large number of the second ranking crops decreased in these areas. The outstanding decrease however occurred in the areas of jowar-arhar mixed and bajra-arhar mixed and fodder.

During 1931, the distributional pattern of the second ranking crops as indicated in Fig. 73 clearly reveals that the area under maize and fodder as second ranking crops had expanded. The area under second rank maize had increased mainly in the districts of Saharanpur and Bulandshahr in the Upper Doab, while Etah and Farrukhabad in the middle Doab. The area under fodder as second ranking crop was increased mainly in the
Saharanpur, Muzaffarnagar and Meerut districts of Upper Doab. The other second ranking crops namely sugarcane, jowar-arhar mixed, bajra-arhar mixed, wheat-gram mixed, barley and rice recorded insignificant areal increase in the region. In the same year the second ranking crops like wheat, gram and barley-peas mixed showed a marked decrease.

Wheat as the second ranking crop lost much area in Aligarh district, where it was replaced by barley, bajra and barley-peas mixed. Gram as a second ranking crop was holding a considerable area during the last decades, but it could not occupy even a single pargana in this year. In most of the parganas in Upper Doab, gram as second ranking crop was replaced by fodder and sugarcane, while in other parts of the region maize, jowar and bajra replaced it. The other second ranking crop which had lost its significance in 1931, was barley-peas mixed. In about nine parganas barley-peas mixed as second ranking crop gave the place to the second ranking crops like wheat, maize, jowar and bajra.

Fig. 74 shows that during 1941 there was a general areal expansion of majority of crops under study. A considerable area had come under sugarcane as second ranking crops. The wheat gained the second
ranking position in Bulandshahr district of Upper Doab, Aligarh and Etah districts of middle Doab. Sugarcane cultivation had elevated its position as a second ranking crop in north-eastern parts of Saharanpur, Muzaffarnagar and Meerut districts of Upper Doab. The other second ranking crops which showed a marginal increase in the region are wheat-gram mixed, gram, barley-peas mixed, bajra, jowar and fodder. The only second ranking crops which recorded a decline during this decade are rice and maize. Rice being an important second rank crop of Saharanpur and Muzaffarnagar districts was replaced by sugarcane and wheat in the Upper Doab, and by barley-peas mixed and bajra in the lower Doab.

During 1951 the distributional pattern of the second ranking crops as indicated in the Fig.75 reveals that after a lapse of two preceding decades (1931 and 1941), wheat again emerged as important second ranking crop of the region and occupied about thirtytwo parganas, which were concentrated largely in Upper and the middle Doabs. Wheat-gram was the other second ranking crop which improved its position, and occupied almost the same number of parganas as in 1921 and 1931. Barley and peas also showed slight improvement over the last decade. The maize which had been occupying considerable area as
second ranking crop, had declined considerably. The other second ranking crops which did not gain in areal extent are barley—peas mixed and sugarcane. Bajra and fodder however remained unchanged.

In 1961 a significant change occurred as shown in Fig. 76 second ranking wheat further improved its position, and occupied nineteen more parganas mainly in Upper and middle Doab districts, where it replaced largely the second ranking fodder and sugarcane in the Upper Doab and bajra, maize and barley in the middle Doab.

The dominant second crops to wheat were peas and maize, which gained a considerable area in most of the middle Doab districts. In the same year the two second ranking crops, namely sugarcane and fodder had lost a considerable area in the Saharanpur, Musaffarnagar and Meerut districts of Upper Doab. The other second ranking crops which could not occupy the pre existing position are barley and rice.

**Third Ranking Crops (Distribution and Changes 1911 to 1961)**

Fig. 71 indicates that during 1911 maize was an outstanding third ranking crop with large compact areas.
In fact it was widely distributed all over the region. The most conspicuous areas under maize fell in the districts of Bulandshahr, (Upper Doab), Aligarh, Etah and Mainpuri (middle Doab).

The other important third ranking crops were fodder and sugarcane, which were mostly concentrated in the Upper Doab and in some parts of middle Doab. Barley-peas mixed, bajra-arhar mixed and jowar-arhar mixed occupied larger parts of Etah and Mainpuri in the middle Doab, and few small parts in lower Doab.

The distributional patterns of third ranking crops in the year 1921 as shown in Fig. 72 shows a close similarity to the pattern of the preceding decade of 1911.

Fig. 73 shows that in 1931 a substantial change had occurred. In this period sugarcane emerged as the third ranking crop in the districts of Saharanpur, Muzaffarnagar and Meerut in the Upper Doab. Wheat which was not a third ranking crop in 1911 to 1921, now emerged under this rank in a tract between Aligarh and Etawah along the river Yamuna in the middle Doab.

Fig. 74 shows that in 1941 fodder as a third ranking crop had been greatly replaced by sugarcane in
almost all the districts of the Upper Doab and in Aligarh and Etah districts of middle Doab.

Wheat as a third ranking crop was mainly confined to the districts of Etawah and Kanpur in the lower Doab, while gram and rice occupied larger parts of Upper Doab and lower Doab.

Fig. 75 shows that in 1951 sugarcane and fodder still held a dominating position in the districts of Upper Doab. Besides these, gram occupied a substantial area on the western margins of Upper Doab and middle Doab. Another important third ranking crop in this period was wheat-gram mixed, which after replacing wheat and barley occupied considerable area in Etah, Mainpuri, Farrukhabad and Etawah districts of the middle Doab.

A striking change in 1961 as shown in Fig. 76 was that sugarcane as third ranking crop was eliminated from almost everywhere in the districts of Saharanpur, Mirzapur and Meerut in the Upper Doab.

It may be recalled that during 1951, 1961 sugarcane had emerged as a first rank crop in the upper Doab region so all that has happened is that it has appreciated its position from third ranking crop to a first ranking crop.
Sugarcane as a third ranking crop, has been replaced by wheat, gram mixed, maize, gram, wheat and fodder. The position of wheat in this region had fallen as a first ranking crop to a third ranking crop in the upper Doab. Agra districts and in lower Doab districts of Etawah and Zanpur district. The position of other third ranking crops remain practically unchanged.

The changes in the distributional patterns of crops and their relative ranks is the outcome of action and inter-action of various factors affecting agriculture, like soil and climate and socio-economic factors.

The three districts of upper Doab namely Saharanpur, Muzaffarnagar and Meerut are quite distinct in having light rich loam with admixture of sand and clay. These soils are very favourable for the growth of wheat. Apart from fertile soil, adequate irrigation facilities, use of small scale mechanised implements, easy availability of credit facilities are some of the factors giving rise to large scale cultivation of wheat and sugarcane.

The figure showing the distribution of first ranking crops for the years from 1911 to 1951 reveal that the core area for wheat is confined to the above-mentioned districts of upper Doab. A small area under
wheat is also found in districts of Etah and Mainpuri in the middle Doab.

The development of canal irrigation coupled with the growing population pressure on the land have led to change the cropping pattern in the entire region in general and in the upper Doab in particular during the two last decades (1951 and 1961) under study. In these decades sugarcane has replaced the most important pre-existing first ranking wheat crop in various districts of the upper Doab.

The middle and the lower Doab do not show any significant change as far as the cropping patterns are concerned. The dominating first ranking crops for a majority of decades can be named as barley-peas mixed jowar-arhar mixed and bajra-arhar mixed.

**Total Volume of Change**

The changes among the crops that are leading occupiers in the Ganga-Yamuna Doab have already been examined. It now seems worthwhile to study the changes of all the crops under study taken in the accumulated form.
The total change in the acreage of the above crops taken as a group may be considered with a view to find out the areas where the cropland use patterns have been stable or dynamic. A tallying of the percentage points of increase and decrease among these crops has therefore been taken to provide a reasonably accurate comparative measure of the total volume of change that has occurred over a period of fifty years (1911 to 1961) recorded at decennial intervals.

The measure of percentage of that harvested cropland involved in the change among the selected crops for each pargana has been attained with the help of summation method.

1. Among the crops that share the total harvested land in the region under study, sixteen crops have been discussed while the rest of the crops having little bearing on the amount of the total volume of change have been omitted.

2. The summation method worked out below is very simple:- For every crop an abbreviated fractional expression has been prepared and the percentage points of increase and decrease have been calculated for crops occupying the letter cropland in each pargana in the region. A crop identifying/together with any existing percentage point of increase is placed in the numerator of the fraction and an identifying letter together with any existing decreasing value has been placed in the denominator. The percentage point values of the numerator and denominator have been added up separately. The two sums indicating a numerical fraction as a result of these computation an index has been made available for indicating the total percentage of the harvested cropland affected in a given pargana on account of the change in relative strength of the crops.

Supposing that after the computation the fraction 18/12 for a particular pargana is obtained it would then clearly indicate that eighteen per cent of the

contd...
GANGA-YAMUNA DOAB
TOTAL VOLUME OF CHANGE
1911-21
PERCENT OF TOTAL HARVESTED CROPLAND INVOLVED IN CHANGE AMONG THE MAJOR CROPS

INDEX

- 20-40 PERCENT
- BELOW 20%
- NA DATA NOT AVAILABLE

KILOMETRES
The Figs. 77 to 81 show a comparative view of areas where the cropland use pattern are either relatively stable or dynamic. It may be stated the areas where the change among the selected crops less than 20 per cent of the total cropland is put under relatively stable category, while those areas where the magnitude of the total change is between 20 and 40 per cent of the total cropland has been categorized as unstable or sensitive.

An examination of Fig. 77 shows that the condition of relative instability during 1911 and 1921 prevails over the larger areas of Ganga-Yamuna Doab. The most distinct areas in this respect however located in three districts of Upper Doab namely Saharanpur, Nuzaffarnagar and Meerut. And two districts of Fatehpur and Allahabad in lower Doab. Some parts of the districts Aligarh, Mathura, Agra, Etah and Mainpuri in the middle Doab also show unstable areas. The areas which were relatively stable as regard the total volume of change were confined to the districts of Bulandshahr (Upper Doab), Etah, Farrukhabad, and some portion of Mainpuri, and Etawah districts of middle Doab. In the lower Doab Kanpur and a small patch in Fatehpur district show the stable areas.

Contd....2

harvested land has increased under certain crops and twelve per cent has decreased under other crops, the larger of the two digits has therefore been plotted on the maps for that pargana because of the fact that the percentage of total cropland is involved in some form of land use among the selected crops.
GANGA-YAMUNA DOAB
TOTAL VOLUME OF CHANGE
1921-31
PERCENT OF TOTAL HARVESTED CROPLAND INVOLVED
IN CHANGE AMONG THE MAJOR CROPS

INDEX
- 20 - 40 PERCENT
- BELOW 20
- NA DATA NOT AVAILABLE

Fig 70
GANGA-YAMUNA DOAB
TOTAL VOLUME OF CHANGE
1931-41
PERCENT OF TOTAL HARVESTED CROPLAND INVOLVED IN CHANGE AMONG THE MAJOR CROPS

INDEX
- 20—40 PERCENT
- BELOW 20
- NA DATA NOT AVAILABLE
GANGA-YAMUNA DOAB
TOTAL VOLUME OF CHANGE
1941-51
PERCENT OF TOTAL HARVESTED CROPLAND INVOLVED IN CHARGE AMONG THE MAJOR CROPS

INDEX

20 - 40 PERCENT

BELOW 20

Fig 80
GANGA-YAMUNA DOAB
TOTAL VOLUME OF CHANGE
1951-61
PERCENT OF TOTAL HARVESTED CROPLAND INVOLVED IN CHARGE AMONG THE MAJOR CROPS

INDEX

\[
\begin{align*}
\text{\textbf{20 - 40 PERCENT}} & \quad \text{\textbf{BELOW 20}} \\
\end{align*}
\]

KILOMETRES
During the decade between 1921 and 1931, as it is indicated in the Fig. 78 reveals clearly that the stable areas have slightly expanded in the Upper Doab mainly in the district of Saharanpur and in districts of Aligarh, Mathura, Agra and Mainpuri of middle Doab. Fatehpur and Allahabad districts of lower Doab also show a slight expansion of stable areas. During this decade the unstable areas on the other hand have expanded in the districts of Farrukhabad, Etawah of middle Doab and in Kanpur districts of lower Doab.

During the decade between 1931 and 1941 the area showing instability during preceding years has largely contracted as is shown in Fig. 79. However during 1941 and 1951 again the expansion of unstable areas occurred in the upper and middle Doab as is shown in Fig. 80.

During the decade between 1951 and 1961 (Fig. 81) a substantial expansion of stable areas has taken place throughout the region.

Taking the trend of the distributional patterns of dynamic or stable areas into consideration. It may well be concluded that in Ganga-Yamuna Doab much of the stable areas lie in the middle and lower Doab. On the other hand, the dynamic or sensitive areas are generally confined to the Upper Doab districts.
In the developing agricultural sciences, the importance of combinational analysis of different elements in a study of cropland use can hardly be over emphasized. To know and to analyze variable positions of individual crop within themselves as their integral complex, the study of crop combination regions becomes indispensable. The study further reveals the important features of agricultural landscape of an area. As a matter of fact, crops associate one another not by mere chance but as a result of deliberate option, and the choice is not arbitrary, but on the other hand selected on the basis of environmental conditions, such as climate, hydrologic and edaphic controls, and economic influences and social behaviour prevailing at that time. The study of crop association, therefore not only concerned with agricultural landscape but gives an appropriate measure, as to how the human response is involved in diversified and complex aggregate environment.

Various statistical methods have been applied to delimit crop regions. In the early twenties and thirties,
the method was generally based on single crop distribution, but such crop regions presented over generalized, over simplified picture of agricultural regions e.g., Corn belt, Cotton belt and wheat belts in different parts of the world. The demerits of such single crop regions has very well been highlighted by Weaver in his article "Crop Combination regions in Middle western regions of United States of America". He cites an example of corn belt, where in corn is not a uniformly pre-eminent crop. As a matter of fact in some parts of corn belt, the land use position of corn in relation to other crops is more nearly like that in certain distinctly non corn belt districts than like that in other parts of corn belt itself.

On the basis of the scale of level of importance for selected crops calculated from the mean or average for the farmer. 'East Pakistan' (now called Bangla Desh), the areas of very high, high, medium, low, very low importance were demarcated, and grouped into district regions by Johnson. It might hold good for a particular country or a region taken as a whole, but involves a lot of calculations in respect of a very large number of small units like pargana or block in a region.

A slight improvement on the above method was introduced by Nelson who calculated the standard deviation, and put at least three grades on account of the deviation from the mean for each function in the following manner: average plus

1. Standard deviation ($S.D.$), average plus 2.
2. Standard deviation (2 $S.D.$), and average plus 3 standard deviation (3 $S.D.$). All the values so obtained are grouped together provided of course, they are more than the average and rated as 1, 2, 3 or (High, medium and low). This method may be suitable where an over all picture of relative importance of various crops in each unit is required for the whole region. But in these cases no consideration is given to leading crops of individual units. It often happen that leading crops are excluded while the lower ranking crops are included in the combination. It would be more proper, to group these crops of the unit, which have a positive deviation from the average of all the crops in the same unit itself.

In 1934 Weaver adopted a statistical formula for crop combination analysis of the agriculturally important region of middle west in the U.S.A. The method

popularly known as minimum deviation was calculated in terms of real percentages for all the possible combinations in the unit taken into consideration, against a theoretical standard was 100 per cent in a single crop, 50 per cent in each of two crops for two crop combination, 33.3 per cent in each of three crops for three crop combination and so on.

Weaver's method suffers from certain limitations. It involves a good deal of mathematical calculations, and tends to produce a highly generalised picture in areas having large number of variants or areas where the first ranking crop has a very large percentage. Doi has modified Weaver's method by substituting \( \frac{d^2}{n} \) with \( d^2 \) or the sum of the squared differences, and therefore the combination having the smallest \( d^2 \) will be the combination formed by major crops only.

As a result of statistical processing of data according to Doi's method, an attempt has been made to delineate the crop combination regions in Ganga-Yamuna Doab, with their distributional change that have taken place during a period of fifty years (1911 to 1961).

GANGA-VAMUNA DOAB
CROP COMBINATION REGIONS
1911

DETAILED CROP COMBINATIONS ARE MENTIONED ON APPENDIX I ON PAGE
GANGA-YAMUNA DOAB
CROP COMBINATION REGIONS
1921

Detailed crop combinations are mentioned in Appendix 3 on page...

Fig. 83
GANGA-YAMUNA DOAB
CROP COMBINATION REGIONS
1931

DETAILED CROP COMBINATIONS ARE MENTIONED
IN APPENDIX 3 ON PAGE

Fig. 84
The entire period has been divided into five decennials. The crop combination regions have been delineated for each decennial and depicted on the maps (Figs. 82 to 87).

It will be seen from the Figs. 82 to 87 that the most salient feature of the crop combination region is the absence of mono culture, two and three crop combinations during 1911, and mono culture and three crop combinations during the rest of the period under study.

THE CHANGES IN THE SPATIAL DISTRIBUTION OF CROP COMBINATION REGIONS DURING FIVE DECENNIALS COVERING A PERIOD OF FIFTY YEARS (1911 to 1961)

Three Crop Combination Regions

Fig. 82 would show that three crop combination regions do not appear anywhere in the region. However they can be seen in the decade ending 1921 in Fig. 83 that at least in one pargana Bidauli belonging to district of Muzaffarnagar in the Upper Ganga-Yamuna Doab. Here, grain, wheat and fodder are the three crops in the combination. Fig. 84 shows that in 1931 the three crop combination region occurs in the Saharanpur pargana of Saharanpur District where wheat combines with rice and
GANGA-YAMUNA DOAB
CROP COMBINATION REGIONS
1951

DETAILED CROP COMBINATIONS ARE MENTIONED IN APPENDIX 5 ON PAGE

Fig. 96
GANGA-YAMUNA DOAB
CROP COMBINATION REGIONS
1961

DETAILED CROP COMBINATIONS ARE MENTIONED IN APPENDIX ON PAGE...
fodder. Again during 1941 the above combination also occurs in the Shamli pargana of Musaffarnagar district where fodder is the leading crop followed by wheat and sugarcane. (Fig. 85).

In 1951, this combination appears in Daurala pargana of Meerut district (Fig. 86). Sugarcane is the leading crop associated with wheat and fodder.

However, by 1961 the three crop combination appears only in one pargana Shikarpur of Musaffarnagar district of Upper Doab. (Fig. 87)

It will thus be seen that the regional extent of the three crop combination is restricted to three districts of Upper Doab namely Saharanpur, Musaffarnagar and Meerut. Secondly there are five crops namely wheat sugarcane, fodder, rice and gram which are involved in the combination in the different parganas spread over five decades, thirdly sugarcane appears in the combination in the latter half of the period under study.

Four Crop Combination Regions

Fig. 82 shows that the four crop combination regions occur in two Upper Doab district namely Saharanpur and Musaffarnagar.
Four parganas namely Faisabad, Muzaffarabad, Gongoh and Deoband lying on the western margins in Saharanpur district, and six parganas namely Baghra, Charthawal, Thana Bhawan, Bidauli and Khatauto, covering the central part of the district of Muzaffarnagar fall in the four combination regions.

This combination is hardly seen in the Middle Ganga-Yamuna Doab. However in the Lower Doab, three wide scattered patches covering Akbarpur, Hathgaon and Kotila lying in the Kanpur and Fatehpur districts pass the above mentioned combination. Wheat occupies a larger share in the combination, than other crops like gram, fodder and sugarcane. In the Lower Doab, on the other hand, coarse grain crops like barley-peas (mixed), and big millets-pigeon pea (mixed) predominate in the combination. By 1921 the four crop combination in many parganas disappears with the result that the areal coverage under this combination shrinks to a marked extent. Only five parganas namely Baghra and Shamli in Muzaffarnagar, Chaprauli in Meerut, Hathgaon and Kotila in Fatehpur districts pass the above mentioned combination. The parganas of Baghra, Hathgaon and Kotila however retain 1911 position. Wheat holds a dominating position followed by gram, fodder and rice. Sugarcane is eliminated from the combination. (Fig. 85)
Fig. 64 shows that during 1931, with the exception of Baghra pargana (Musaffarnagar) the four crop combination extends further to seven other parganas e.g. Sultanpur, Sarawa and Nagal (Saharanpur), Jhinjhana (Musaffarnagar) Daurala (Meerut), Kotiagunier and Ghazipur (Fatehpur). The crops that are involved in the combination are wheat, fodder, barley-peas (mixed) millets and pigeon pea (mixed), rice, maize, peas and sugarcane. Wheat is a dominating crop in the combination in the Upper Doab followed by fodder and sugarcane, while barley-peas (mixed) is the major crop followed by millets-pigeon pea (mixed) and rice in the above mentioned combination in the Lower Doab.

A comparison of Fig. 84 and Fig. 85 shows that during 1941 the area under the four crop combination has further extended. This combination covers a considerable area in Musaffarnagar district, where five parganas (Musaffarnagar, Charthawal, Gordanpur, Bhokaheri and Jecti Jansath) lie in the eastern Kali Nadi - Ganga tract and three parganas (Jhin Jhana, Kairana and Bidauli) lie in the Kishna-Yamuna tract. The parganas of Gonga and Desband lying in the Saharanpur district and Chaprauli and Daurala in the Meerut district also show the four crop combination. The same combination occurs in the
parganas of Kanpur and Kora in the district of Kanpur and Fatehpur lying in the Lower Doab. During this period sugarcane and fodder have improved their position and hold the second rank in most of the parganas.

The areal distribution of four crop combination regions for the decade ending in 1951, as depicted in Fig. 86 reveals that the areas covered by the above combination in the previous decades have been interrupted and become limited in extent and spread over only six parganas in the Upper Doab via Saharanpur and Rampur in the Saharanpur district, Baghra, Shamli and Kandhla in the Muzaffarnagar district, Chaprauli in Meerut district. Only one pargana Hathras of Aligarh district in Middle Doab and two parganas, Ghazipur and Karari belonging to the districts of Fatehpur and Allahabad respectively in the Lower Doab also show the same combination.

Adequate facilities of irrigation from tube-wells, increasing demand for sugar, better transport facilities and easy access to local markets led to the increase of the sugar cultivation particularly in the Upper Doab.

The componental behaviour of the crops in the Lower Doab districts has remained more or less the same.

During 1961, the distributional pattern of four crop combination can well be appreciated by the fact that a considerable expansion of areal coverage under this combination has taken place.
Fig. 87 shows that the greater degree of concentration still persists in the Upper Doab districts namely Saharanpur, Musaffarnagar and Meerut, while the districts of Aligarh and Farrukhabad in the Middle Doab and Kanpur, Fatehpur and Allahabad in Lower Doab show such a combination in patches.

In Upper Doab the parganas of Nakur, Gongah and Manglaur of Saharanpur district, Charthawal, Parchapur, Musaffarnagar, Godhanpur, Kairana, Jhin Jhana, Bidauli Bhoma Sambhalheri, Jeoli Jansath and Kandhla of Musaffarnagar district and Baraut, Chaprauli and Meerut of Meerut district hold the above combination, while the parganas of Northal in Aligarh District and Chhibramou in Farrukhabad district in Middle Doab, along with pargana Akbarpur and the pargana Kanpur in Kanpur district, parganas Kora, Aya Shah, Hathgaon in Fatehpur district, and the parganas Karari, Atharban of Allahabad district also show the four crop combination.

It will be seen from the Fig. 87 that some striking changes have occurred in the relative ranks of crops that form the four crop combination. Wheat, which constantly occupied the dominant position in the previous decennials has come to occupy the second place in the Upper Doab districts, and sugarcane has emerged as the
leading crop. Fodder, rice and maize occupy either third or the fourth position.

**Five Crop Combination Regions**

Fig. 82 shows that the five crop combination is largely concentrated in Muzaffarnagar district of the Upper Doab, where six out of fifteen parganas show this combination. The other fragmented areas with this combination are the parganas of Saharanpur, Nagal (Saharanpur district) Hasthanapur and Chaprauli (N Meerut district).

Firozabad in Agra district is the only tehsil in the Middle Doab which shows the five crop combination. It is quite significant that five crop combination is completely absent in Lower Doab. This is perhaps because the soils of the districts of the Lower Doab are sandy to sandy loam, irrigation facilities are much less, and the poverty of the people has led to the large scale dependence on cereal crops.

It may further be seen that with the exception of Firozabad in the Middle Doab wheat is the major crop in the five crop combination.

The distributional pattern of this combination in 1921 (Fig. 83) shows that two clusters, one lying in the Upper and the other in the Lower Ganga-Yamuna Doab
are of some significance. In the Upper Doab a large area under this combination is covered by two districts namely Saharanpur and Muzaffarnagar. Ten out of the fifteen parganas in the district of Saharanpur and six out of seventeen parganas in district of Muzaffarnagar show the emergence of five crop combination. Three parganas in Meerut district can also be included in the above block. Wheat is the leading crop in almost all the areas under this combination. Wheat is followed by rice, gram, sugarcane and fodder. Maize, big millets and barley are some other crops which enter in the combination with a negligible percentages.

In the Lower Doab the patches of five crop combinations include about ten parganas. It is however significant to note that wheat does not find a place in the combination. The important crops associated in this combination are: Barley peas (mixed) bulrush millets mixed with pigeon pea and rice. This disappearance of wheat can be explained by the fact that the sandy soils and inadequate irrigation facilities has led the cultivation of poor cereals like millets and pigeon pea.

Fig. 84 shows the areal distribution of five crop combination during decade ending 1931. It will be seen from Fig. 84 that the area under the five
crop combination has been reduced to a large extent particularly in Saharanpur district where only four parganas could retain their previous position. The district of Nasaffarnagar in the Upper Doab does not show much change.

In the district of Meerut of Upper Doab there are not much changes in areal extent of this combination. In the Aligarh district of Middle Doab, it occurs only in the pargana Nortal.

In Lower Doab the five crop combination occurs in the parganas Ghatampur and Kanpur in the district of Kanpur, after a gap of twenty years, while the pargana of Akbarpur is a new addition. The two parganas Ayah Shah and Ekdala in Fatehpur district retain the previous position and another pargana namely Kutila is added to this area. Wheat again holds a predominant position in all the parganas of Upper Doab districts. The other important crops are suga rosee and fodder, while barley-peas (mixed) is the leading crop in a large number of parganas in the Lower Doab with rice taking an important position.

The Fig. 85 for 1941 shows that the areal spread of the five crop combination region has gradually increased compared to the previous position in the Upper Doab.
In Meerut the area under this combination was confined to only two parganas (Chaprauli and Baraut) during preceding decade, but it has expanded by incorporating four more parganas (Barnawa, Kulana, Hasthanapur and Kithore).

The degree of concentration of the five crop combination in the Middle Doab is very limited (Fig. 85).

The spatial distribution of the five crop combination in the Lower Ganges-Yamuna Doab does not show any significant change. It will be seen from Fig. 86 that there is a small patch (tehsil Etawah of Etawah district) which shows this combination after a long gap of two decades e.g., 1921 and 1931. Fig. 86 further shows that the tehsil Bhognipur enters as a five crop combination region for the first time in Kanpur district, while in the same district, tehsils Akbarpur and Chatampur continue as five crop combination. The areal dimension of the five crop combination in Fatehpur district remains somewhat stable, where three parganas (Haswa, Mutaur and Ekdala) lying in the southwest are included.
In Allahabad district, there is a small patch with this combination covered by one pargana Atharban.

With regard to the relative position of the crops, wheat still occupies a leading position in the majority of the five crop combination regions particularly in the Upper Doab districts, although in a substantial number of parganas either rice or sugarcane shows a leading position.

Fodder which held a second rank in the previous decades has shrunk in area.

In the Middle Doab, a significant change in the relative position of crops may be seen, where wheat loses its importance and has almost disappeared.

Figs. 86 and 87 show a close similarity in the distributional pattern of the five crop combination regions.

Among the districts lying the Upper Doab, Musaffarnagar shows the largest concentration, where ten parganas (Musaffarnagar, Charthawal, Punchpur, Bhoa, Sambhalheri, Jioli Jansth, Shikarpur, Kairana, Jhin Jhana, Thana Bhawan and Bidauli) fall in the five crop combination regions.
The distributional pattern of the above mentioned combination regions in the remaining districts does not show any noticeable change.

Fig. 87 further shows that with the exception of tehsil Shikohabad in Mainpuri district, the entire area of the Middle Doab is devoid of five crop combination region. However in the Lower Doab, Fatehpur district contains fairly a large number of parganas (Bindki, Kora, Aya Shah, Hathgaon, Ekdala and Dhata) having five crop combination regions.

Wheat holds the leading position in almost all the parganas of Upper Doab, while fodder occupies the second place in about fifty per cent of the parganas in the Upper Doab.

The nature and relative position of the five crops forming the combination in the Middle and Lower Doab is distinctly different from the Upper Doab. Instead of wheat, fodder and sugarcane, barley-peas (mixed) and mixed crops like millets and pigeon pea takes the leading positions. Rice also holds first place in some places.
Six Crop Combination Regions

Fig. 82 shows areal distribution of six crop combination regions in the Ganga-Yamuna Doab for the decade ending 1911. The area under this combination has expanded in the district of Saharanpur. But in Musaffarnagar it has been reduced and is confined to only two parganas of Purchapur and Budhana. A slight expansion in the area under the six crop combination also occurs in Meerut district. It may also be observed from map (Fig. 82) that the six crop combination regions tends to concentrate in a few pargana lying in different districts of the Middle Doab, for instance, parganas Barauli, Etah Sakit, Barnahal and Mohammadabad in the districts of Aligarh, Etah, Mainpuri and Farrukhabad respectively.

As regard the relative strength of different crops constituting this combination wheat is the leading crop and combines with fodder, sugarcane, rice, gram, barley, bulrush millet and bulrush millet-pigeon pea (mixed), maize and wheat-gram (mixed). The Middle and Lower Doab, on the other hand shows a different pattern of association of crops. For instance, instead of wheat, inferior cereals like barley-peas (mixed) and millet-pigeon pea (mixed) stand first in a number of
parganas, while in the remaining parganas a mixed crops
like millets and pigeon pea found to occur. Wheat now
occurs in very limited number of parganas assigned to
this combination. The other crops that enter the combination
with a relatively low strength are: barley-peas (mixed),
millet-pigeon pea (mixed), maize, rice, barley and wheat-
gram (mixed).

Fig. 83 shows that after a decade (i.e. in 1921)
the area under six crop combination has expanded in the
two districts of Musaffarnagar and Meerut belonging to the
Upper Doab, and experienced a contraction in Saharanpur.
A little increase in the area is also marked in the Etah
district of Middle Doab. The areal extent of this
Doab combination in the Lower/shows almost no change.

Wheat does not lose its hold as first rank crop
in the Upper Doab. While in sufficient number of parganas
fodder, rice and other crops like barley, wheat-gram
(mixed), and sugarcane constitute second or third rank
crops.

The highest place in several six crop regions in
the Middle and the Lower Doab is enjoyed by millets-pigeon
pea (mixed), barley-peas (mixed) and wheat.

It is significant to note that cotton enters for
the first time in some six crop combination regions
(Fig. 83 ). In the Faisalabad and Bawalaur parganas,
both from Saharanpur district cotton occupies fifth and
sixth place respectively.
A comparison of Fig. 82 and 83 shows that the areas occupied by six crop combination regions have been enlarged in the districts of Saharanpur, Musaffarnagar and Meerut.

In Saharanpur district, with an addition of one more pargana the six crop combinations are spread over the parganas of Faisabad, Harura and Rampur. There are only three parganas in Musaffarnagar district and two in Meerut district having this crop combination (Fig. 84). The same crop combination regions assume prominence in the Middle Doab districts specially in Etah and Farrukhabad, where six parganas in the Etah district namely Pushtana, Ulai, Soron, Sahavar, Asamnagar and Sidhpyur parganas and five parganas: Shamsabad east, Mohammadabad, Shamsabad west, Chibramau and Kamnaj which form a thin belt in the eastern part of the district Farrukhabad along river Ganga. In the same district two other scattered parganas (Sakatpur and Sakrawa) are also included in the crop combination.

As a whole the six crop combination regions in the Lower Doab as compared to last decade shows a scattered distribution.

Wheat maintains its outstanding position in almost all the six crop combination regions in Upper Doab as well as in most of the parganas in Etah and Farrukhabad districts of Middle Doab. In the remaining areas of the districts Etah and Farrukhabad, millets-pigeon pea (mixed), rice and barley-peas (mixed) dominate.
There is no significant change in the distributional pattern of the six crop combination regions during 1941 compared with that of 1931 except that the area in Saharanpur under this combination has slightly increased.

A similar extension of this combination can also be seen in the Mainpuri district.

With the exception of a few parganas wheat occupies the first place in all the parganas of Middle Doab. In the Lower Doab, however, big millets mixed with pigeon pea, barley-peas constitute as the first ranking crops in a large number of parganas.

Fodder which held second rank is replaced by sugarcane in a number of parganas of Upper Doab districts, while mixed crops like wheat and gram, big millets and pigeon pea constitute the second ranking crops in the Middle and Lower Doab districts.

The year 1951 is characterized by minor fluctuations in areas covering six crop combination regions.

Fig. 86 further shows that in Saharanpur district four parganas (Sarsawa, Sultanpur, Jwalapur and Gordhanpur) show the six crop combination. In Muraffarnagar in addition to Khatsuli (Fig. 86) two new parganas (Behkaheri and Badhana) have been added (Fig. 86). A large concentration of this combination occurs in Meerut district where six parganas (Napur, Path, Barana, Sardhana and Hasthanapur)
cover this combination. However, the pargana of Sardhana continues to have this combination since 1941.

All but two districts (Farrukhabad and Mainpuri) in the Middle Doab show a trend toward stability in the areal extension of six crop combination.

The above mentioned crop combination displays the highest areal concentration in Patehpur district of Lower Doab, where four parganas (Haswasa, Tappajar, Kutiaagunur and Kotila) could be mentioned.

The only change in the relative position of the six crops that form the above mentioned combination occurs with reference to sugarcane, which begins to aquire first place after replacing wheat in at least two parganas of Khatauli and Fath belonging to the two districts of Musaffarnagar and Meerut respectively. None the less wheat occupies the leading position in the Upper Doab. The rest of the Ganges-Yamuna Doab generally shows no change in the relative position of the crops.

Fig. 87 shows the change in the patterns of six crop combination during 1961. It may be seen from Fig. 87 that in the Upper Doab the parganas Desband, Meerkee, Jwalapur and Sarowsa in the Saharmpur district, Sardhana, Jalalabad and Baghat in Meerut district, Amuashahr and Agota in Bulpandshahr district occupy this crop combination. In the
majority of the parganas in Saharanpur district, sugarcane emerges as the first ranking crops, but in the remaining parganas of the Upper Doab wheat occupies the leading position.

**Seven Crop Combination Regions**

The dynamism of the seven crop combination regions in the Ganga-Yamuna Doab could well be assessed by interpreting the spatial distribution throughout the period under study (1911 to 1961).

**Fig. 82** shows the regional distribution of the seven crop combination for the year 1911.

**Fig. 82** shows that in the Upper Doab the main concentration is found to occur in Meerut district. Six parganas namely Sarana, Jalalabad, Baghat, Baraut, Barnawa and Sardhana) located in Meerut district. Besides that there are three parganas (Kandha, Bhokaheri and Gordhampur) in Musaffarnagar district, which also show this combination. But in two other districts (Saharanpur and Bulandshahr) of Upper Doab there is a small patch in the form of pargana Dibai in the Bulandshahr district which show this combination.

The concentration of the seven crop combination regions, however seem wide spread in three districts (Bhah, Nainpuri and Farrukhabad) located in the Southern part of
the Middle Doab Ganga-Yamuna Doab. Nine parganas in the
Etah district, five parganas in Farrukhabad and three
parganas in Mainpuri district show this combination.
There is a small patch spread over two parganas in Aligarh
district and one each in Mathura and Agra districts also
show the above combination.

The Lower Doab does not show any significant area
under the seven crop combination (Fig. 82 ). Only one
pargana Bindki in Fatehpur and two parganas: Kara and
Karari in Allahabad district show this combination.

Wheat dominates the agricultural scene in Upper Doab
and Middle Doab in this combination too. The other crops
which can be mentioned as holding first rank in the seven
crop combination are wheat-gram (mixed), barley-peas (mixed)
and big millets-pigeon pea (mixed).

The proportion of area under the seven crop combination
region even after ten years seems to have increased to a
very limited extent (Fig. 83 ). In the districts of
Saharapur there are three parganas of seven crop regions
(i.e., Musaffarabad, Barnawa and Meerkee) while in the
district of Musaffarmagar there is one pargana Godhanpur.
In Meerut the seven crop regions have been reduced to an
appreciable extent and are confined to parganas Barnawa
and Baghpat.
In the Middle Doab the seven crop association regions have shrunk (Fig. 83), while this combination disappear altogether from Agra, Mathura and Mainpuri districts. In Etah, also, out of nine parganas of the same crop region existing during 1911 there remain only four. Similarly in Farrukhabad it is reduced from five to two.

There have been substantial changes in the distributional pattern of the seven crop combination regions in Lower Doab districts. Fig. 83 shows that tehsils Biddhunia and Btawah in Etawah district, Kanpur, Bilhaour, Bhognipur in Kanpur district show the above association regions. This combination also occurs in two parganas—Tappajar and Dhata in Fatehpur district.

Fig. 83 shows that wheat occupies the first rank in all the nine parganas of Upper Doab which occupy seven crop combinations, while gram occupies largely the second position, fodder ranks as the fourth and maize occupies the fifth position.

Similarly in the Middle Doab the relative strength of crops as seen in Fig. 83 shows that wheat stands first in four out of the eight parganas holding the above combination and is followed by big millet, pigeon pea (mixed). Barley-peas (mixed) maize, barley and wheat-gram (mixed) occupy lower ranks.
Big millets mixed with pigeon pea most commonly occupies first place in the Lower Doab and the subsequent ranks are covered by barley-peas (mixed), maize, wheat, gram and rice.

No marked change in the pattern of the distribution of the above crop region is seen in 1931 (Fig. 84). However, a comparison of Fig. 83 and 84 shows that the pre-existing seven crop combination regions in some parganas of Fatehpur and Allahabad districts in the Lower Doab disappear altogether.

Wheat again dominate the seven crops that are associated in the nineteen out of the twenty-five parganas, the other important crop next to wheat is big millets-pigeon pea (mixed).

Fig. 85 shows the distributional patterns of the seven crop combination regions during 1941. It will be seen from the Fig. 85 that in the Upper Doab this crop region exists in two parganas (Boorkee and Bhagwampur) in the Saharsapur district instead of Musaftarnagar and Jwalapur as in 1931, and one pargana Budhana in Musaftarnagar against three parganas (Furchapur, Budhana and Isadhla) of the last decennial. In Meerut district two parganas (Puth and Hapur) show the above combination regions. Instead of three parganas (Barnawa, Sardhana and Jalalabad) which were existing
during the year 1931. In Bulandshahr the areal distribution has only changed to position compared to the year 1931.

In the Middle Doab with regard to the two points of times (1931 and 1941), these combination regions have been shifted from Brauli to near by pargana Northal in Aligarh district, but it disappears from the tehsil Sadabad of Mathura district. In the district of Etah, however these combination regions extend over a considerable area covering seven parganas (Asamnagar, Patiali, Midhpur, Bilram, Soron, Sidhpur and Faispur). Compared with the last decade, where hardly two parganas (Faispur and Sonhar) were occupying the above mentioned combination. Fig. 35 further shows that the same crop combination occurs in only one pargana Ghior of Mainpuri district, while in Farrukhabad district, after retaining in pargana Bhojpur, the seven crop combination region has been extended to another pargana Shamesabad west.

It will be seen from the Fig. 35 that in addition to the pargana Bhartnaha in Etawah district of 1931 one more pargana Bidhuna shows the same crop combination. It may be mentioned that these combination after disappearing during 1931, reappeared again in two parganas (Fatehpur and district Tappajag) of Fatehpur in the Lower Doab. The district of Kanpur (Lower Doab) like the last decade does not show any such combination regions. But pargana Karari in Allahabad district (Lower Doab) reappears after a gap of one decade.
It is significant to note that, with few exceptions in almost all the districts right from Saharanpur upto Mainpuri, wheat holds the supreme position in the combination, while in the remaining districts situated particularly in the southern parts of the Middle Doab and in whole of the lower Doab area contain numerous crops such as, big millets mixed with pigeon pea, maize, barley-peas (mixed) rice and wheat-gram (mixed) etc. hold first rank.

Fig. 86 shows that in the entire Ganga-Yamuna Doab, hardly any perceptible change in the concentration of seven crop combination regions has taken place. It could however be concluded that in the Upper Doab eleven crops enter into the above mentioned combination.

The seven crop combination region occupies seven parganas out of which three parganas (Haagwanpur, Roorkee and Musaffarabad) lie in Saharanpur and three parganas (Sarowa, Jalalabad and Bagpat) in Meerut districts, while Balandshahr contains only one pargana (Anupshahr). Fig. 86 further indicates that these combination regions are absent in Musaffarnagar district.

As compared to the preceding decade the same combination regions which were occupied by the twelve parganas have now been reduced to nine in the Middle Doab, among which Aligarh constitutes three parganas
(Atsuli, Brauli and Gorai), Etah three parganas (Soron, Sahawar and Sidhpur) and Agra one tehsil (Etimadpur), but disappears in Mathura and Mainpuri districts. In Farrukhabad Sakatpur and Sakrava are the only two parganas which show the above combination.

The seven crop combination regions in the Lower Doab are occupied by five tehsils out of which (Etawah, Bidhuna, Auraiya) lie in Etawah and two (Ghatampur and Bhognipur) in Kanpur district. While the pre-existing seven crop combination regions in the two parganas of Fatehpur and one in Allahabad district have been eliminated altogether.

The distributional change in the patterns of the seven crop combination regions, as seen in Fig. 87 clearly shows that a significant extension in Bulandshahr in the Upper Doab and Etah in the Middle Doab has taken place. Fig. 87 further shows that instead of one pargana of 1951 six parganas namely Sikandrabad, Dadri, Pahasu Ahar Baran and Siana cluster in Bulandshahr district, while in Etah five parganas (Patiali, Sidhpur, Bilram, Pachlana and Faispur) instead of three form a compact block in north-eastern side. Apart from these a feeble change has also occurred in two districts of Mainpuri and Farrukhabad.
It may well be noted that the whole area of the Lower Ganga-Yamuna Doab does not show the seven crop combination regions.

Wheat and sugarcane equally share the first and second ranks in the combination. While peas and maize occupy the lower ranks generally with second, third and fourth positions. Crops occupying still lower ranks are fodder, wheat-gram (mixed) and millets etc. while in the Middle Doab wheat and millets-pigeon peas (mixed) occupy the first three ranks in a large number of parganas.

Eight Crop Combination Regions

Fig. 62 shows that in the year 1911, the eight crop combination regions cover three parganas (Hakur, Jawalapur and Bhagwanpur) in Saharanpur, pargana Hapur in Meerut and pargana Siana in Bulandshahr districts of Upper Doab. In the Middle Doab, the district of Aligarh contains three parganas (Murran, Atrauli and Gangiri). Mathura district one (Mat), Etah district, three (Assamgar, Nidhpur and Sahavar), Mainpuri district four (Ghiror, Kurauli, Bhogaon and Bewar) and the district of Farrukhabad contains three parganas (Talgawar, Kanauj and Sakawa).
Fig. 82 shows that the eight crop combination regions do not occur in the Lower Doab.

During 1921, there is a slight change, as compared to that of 1911 and only one pargana Jwalapur, shows this combination. While in Meerut along with Hayur, three more parganas (Sarawa, Jalalabad and Loni) have been added. In Bulandshahr instead of parganas Siana, Dankaur and Agota include the above crop regions. The district of Aligarh in the Middle Doab retain its previous position. On the other hand three tehsils Sadabad (in Mathura district) Etimadpur and Pirosabed (in Agra district) from a compact black. On the north-western segment of the Middle. It may be seen from the Fig. 83 that in Etah district one pargana, Barma, holds the eight crop combination region in Etah district compared to the previous position. At the same time this crop combination region in Mainpuri district shifts to the parganas Kuraoli, Karhal, Barnahal and one tehsil of Mustafabad. A similar condition occurs in Farrukhabad district where it has been transferred to Bhejpur, Chhibramau and Sakatpur.

In the year 1931, the spectacular concentration of eight crop combination regions as shown in Fig. 84 is clearly seen in the district of Bulandshahr in Upper Doab and two districts (Etah and Mainpuri) of Middle Doab.
In Bulandshahr except Agota, there is an addition of four parganas with this combination namely Dadri, Anupshahr, Bibai and Siana, while in Etah, pargana Barnar retaining its 1911 position. Patiali and Mahrerah are the two additional parganas showing these crop regions for the first time. And in place of four parganas (Kuraoli, Karhal, Barnahal and Mustafabad) in Mainpuri district that possessed this combination in 1921, the same crop association region appears in Girior, Shikohabad and Mainpuri. The rest of the area lying south of the Mainpuri, constituting, Farrukhabad, Etawah, Kannpur-Fatehpur and Doab tehsils of Allahabad district is completely devoid of the above crop regions.

The spatial distribution of eight crop association regions as shown by Fig. 85 seems largely concentrated in Aligarh district in the form of a blank of four parganas namely Kurwar, Brauli, Gorai and Sikandra Rao. A considerable area of the Ganga-Yamuna Doab lies with little change, except that of localized shifting of the above mentioned crop regions from pargana to pargana.

By 1951, the concentration of these crop regions is mainly confined to the Middle Doab, where five parganas namely Patiali, Etah, Sankar, Mahrerah and Jalesar of Etah district show the eight crop combination (Fig. 86).
In Mainpuri district in addition to one pre-existing tehsil Mustafabad, three parganas (Ghiror, Mainpuri and Kishni) are the new addition to the eight crop combination regions. Similarly in Farrukhabad apart from the pargana of Tirwa which showed this combination in 1941, three more parganas (Bhojpur, Talgram and Chhibramou) have been added.

Fig. 87 shows the eight crop combination region for the year 1961. It will be seen from the Fig. 87 that the pargana of Loni in Meerut district Dankaur and Jewar in the district of Bulpundshahr in the Upper Doab shows this combination. This combination is not significant in the Upper Doab.

In the Middle Doab, the eight crop combination gives significance and is spread over sixteen parganas—three in Aligarh district (Murjan, Akrobat and Chandau), one in Mathura (Nat), four in Etah (Barna, Ulai, Soron, Etah and Murrerah), three in Mainpuri (Barnahal, Mainpuri and Mustafabad) and three in Farrukhabad (Mohammadabad, Kamauj and Tirwa). In the Lower Doab there is only a small patch consisting of one tehsil Bilhaur in Kanpur district which occupies this combination.

The change brought about in the relative strength of the crops, involved in the eight crop combination regions, noted against all the subsequent decennials right from
1911 to 1961, clearly point out that wheat as usual occupies first position in the majority of the Upper Doab parganas.

In the Middle Doab wheat again holds the first rank in many of the parganas. But inferior crops such as barley-peas (mixed) and millet-pigeon pea (mixed) are major crops in the Lower Doab.

However, it will be seen from the Fig. 82 to 87 that the general pattern of the crop dominance remains more or less stable. The only significant point which needs a little emphasis is that cotton appears in the combination upto 1941, and afterwards almost disappears in this combination. Another point which rather very significant is that from 1951, sugarcane a neglected crop, emerges as a major component in majority of eight crop combination regions particularly in the Upper Doab district. While no uniform change in the trend of the relative position of the crops constituting the eight crop combination regions in the Middle and the Lower Ganga-Yamuna Doab could be visualized.

**Nine Crop Combination Regions**

Fig. 82 shows that the nine crop combination regions are largely concentrated in the Middle Ganga-Yamuna Doab, while in the Upper Doab there is only a small
patch spread over four parganas (Dadri, Dankaur, Pahasu and Agota) in the Bulandshahr district. Fig. 82 further shows that this crop combination region is entirely absent in the Lower Doab districts.

Wheat as a major component, occurs in at least twelve out of fifteen parganas.

A comparison of Fig. 82 and 83 shows that the nine crop combination regions have slightly extended northward upto Meerut district where two parganas (Loni and Dasna) are of nine crop combination regions. In Bulandshahr the number of pre-existing parganas of the above combination regions have been reduced and at the same time, shifted to the parganas of Dibai and Shikarpur.

In the Middle Doab (Fig. 83) Aligarh has lost two parganas (Hathras and Hasangar of 1911) and instead of that, three parganas (Koil, Atrauli and Goral) are the new entrants. Similarly in the district of Etah two parganas namely Asmanagar and Patialli emerge as nine crop combination regions. In Mainpuri and Farrukhabad districts, the number of the nine crop combination regions appear to have been reduced and are confined to the parganas Alipur Patti in the Mainpuri district, and two parganas (Falgram and Tirwa) in the Farrukhabad district.

A significant change that could be perceived during this year is that the wheat loses its grip as the
first ranking crop in the majority of the nine crop combination regions, and have been replaced by barley—peas (mixed), gram and big millets—pigeon pea (mixed).

Fig. 84 for 1931 shows that the number of parganas with this crop combination regions, as compared to the last decade remains almost the same, however there is a shift from one pargana to another.

Again wheat dominates the combinations, although in few parganas barley, maize and rice occupy the first ranks.

Fig. 85 for 1941 shows that the nine crop combination regions occur mainly in Aligarh district spread over the parganas of Hathras, Akrabad, Atrauli and Hasangarh. Apart from Aligarh three parganas, one each from the districts of Bulandshahr, Etah and Mainpuri show these crop regions.

Wheat holds the first rank in more than fifty per cent of the parganas under this combination.

A further contraction in nine crop combination regions in the year 1951 can be seen in Fig. 86. The same trend is followed during 1961, where only eight parganas appear in the form of small patch in the region under study. (Fig.87)

Wheat and peas are the two main crops occupying the highest place in this combination.
Ten Crop Combination Regions

In all there are sixteen parganas which include the ten crop combination regions during 1911 mostly lying in three districts, namely Meerut containing three parganas (Puth, Loni and Dasna), Bulandshahr with seven parganas (Sikandrabad, Khurja, Jewar, Anupshahr, Ahar, Shikarpur and Baran) in Upper Doab, and the Aligarh comprising five parganas (Koil, Akrabad, Tappal, Khair and Chandaus), and one pargana Tirwa in Farrukhabad district in the Middle Doab. (Fig. 82)

The two rabi crops i.e., wheat and barley-peas (mixed) taken together enjoy the largest percentage share in the majority of the above mentioned combinations in 1911. After ten years in 1921 (Fig. 83 ) the ten crop combination extents further south upto Farrukhabad district, while the upper limit is restricted to Bulandshahr district. Fig. 83 further shows that most of the parganas in the Bulandshahr district (i.e. Sikandrabad, Khurja, Jewar, Anupshahr, Ahar and Baran) and in Aligarh (i.e., Akrabad, Sikandra Rao, Tappal, Khair and Chandaus) show constancy with regard to the association of crops in this combination.

There is a belt running transversally from west to east spread over the parganas of Pahasu and Jewar in Bulandshahr district, Sidhpur, Sidhpur and Bhat Sakit in
Stah district, Mainpuri, Ghior Bhogaon, Alipur Patti and Bewar in Mainpuri district, which also show this combination (Fig. 83).

The same combination regions appear in a fragmented form spread over the parganas of Pahasu, Kampil, Shamsabad west, Saurikh and Sakatpur) in Farrukhabad district. Barley-peas (mixed) and wheat are the two major crops in the combination.

In the decennial following 1921 the above mentioned crop combination region has shrunk to an appreciable extent and the areal distribution is more or less comparable to 1911, where the main concentration was confined to Bulandshahr district (Upper Doab) and Aligarh district (Middle Doab).

It will be seen from the Fig. 84 that there has been a little extension towards west of Aligarh district spread over two tehsils (Mat and Sadabad) of Mathura district. In Farrukhabad district the only remnant of this combination of last decennial is pargana Saurikh. In addition to the two pre-existing parganas (Khurja and Jevar) in Bulandshahr district with this combination, one pargana Shikarpur appears for the first time. Similarly in Aligarh pargana Koil did not show this combination in the last decade, reappears again. In addition to this,
Sikandra Rao, Khair and Chandaus continue along with new parganas (Hathras, Mursan and Hasangarh) got included in this combination.

During the year 1941, the distributional pattern of ten crop combination as shown in the Fig. 85 does not indicate much change. The only change from the last decade is that the areal coverage of the above combination region is reduced in Aligarh district, while a small block reappears in Mainpuri district after a gap of one decennial. There are some scattered patches spread over the parganas of Sahawar in Etah district, Pahara in the Farrukhabad district and tehsil Hat in the Mathura district which show the same crop combination regions.

By 1951, the areal pattern of the aforesaid combination regions, as shown in Fig. 86 reveals clearly that a large concentration occurs in Bulandshahr in the Upper Doab, and some other adjoining districts (Aligarh, Etah, Mainpuri and Farrukhabad) of the Middle Doab.

Eight parganas (Sikandrabad, Dankaur, Khurja, Pahasu, Jewar, Ahar and Shikarpur) in the Bulandshahr district, three parganas (Tappal, Chandaus and Hasangarh) in Aligarh district, two parganas (Asmannagar and Hidarpur)
in Etah district, three parganas (Bhogaoon, Bewar and Alipur Patti) in Mainpuri district and three parganas (Pahara, Kampil and Saurikh) in Farrukhabad district show this crop combination region.

Fig. 87 shows that the ten crop combination region in 1961 has considerably shrunk and is confined to only two parganas (Hathras and Tappal) in the Aligarh district, two parganas (Bewar and Alipur Patti) in the Mainpuri district and two parganas (Pahara and Saurikh) in the Farrukhabad district. Wheat dominates almost in all the combination regions.