CHAPTER: 10
SOIL WATER SYSTEM
AND SUITABILITY
OF SOIL
FOR IRRIGATION
SOIL WATER SYSTEM AND SUITABILITY OF SOIL FOR IRRIGATION

10.1 Soil water relation:

Soil can process and contain considerable amount of water. They can take in water, and will keep doing so until they are full, or until the rate at which they can transmit water into and through the pores are exceeded. Some of this water will steadily drain through the soil (via gravity) and end up in the waterways and streams, but much of it will be retained, away from the influence of gravity, for use of plants and other organisms to contribute the land productivity and soil health.

Soil water relation is a key part of the hydrological cycle, provides support to organisms, interacts with climate, and is a major consideration in ground and surface water supply, environmental and geo technical aspects (wikipedia, the free encyclopaedia).

Soil is a heterogeneous mass and consists of three phases. As for example, the solid phase, the liquid phase and the gaseous phase. Mineral water consists of sand, silt and clay and organic matter forms the solid phase which serves as a framework with numerous pores of irregular shapes and different sizes holding air and water in various proportion. Soil is porous medium and serves as a water reservoir or bank. Water is deposited in this bank as a rent of irrigation and plants draw it during their growth.

Water is retained by a soil particle in the form of an inflim around it, and in the numerous small pores of the soil matrix with forces.

Immediately after rain or irrigation water infiltrates into the soil and continues to move in the soil mass to deeper layers because of the gravitational force. The downward movement of water particularly ceases after a certain time after 48 to 72 hours. The water retained in the soil under this situation is termed filled capacity which forms the upper limit of the available soil moisture for the crop plants. Any further addition of water will not be retained by the soil, but will be lost through deep percolation beyond the roots of a crop. Thus, making it unavailable for the growth of the plants. After wetting of the soil as evaporation and transpiration continue, the soil water goes on diminishing till a point is reached, and then plants are unable to extract it. The moisture content at this stage is termed as permanent wilting point and this sets the lower limit of the availability of soil water. Any moisture below this point will not support plant growth. This region of soil water between the
field capacity and the permanent wilting point is termed as available soil water for crop growth. The values of the available water holding capacity of different major soil types are shown in the following table.

Table: 39 Available water-holding capacity of different soil types

<table>
<thead>
<tr>
<th>Soil texture</th>
<th>Field capacity (FC)</th>
<th>% of Permanent wilting point (PWP)</th>
<th>Bulk Density g/cc (BD)</th>
<th>Available water (mm) per metre depth of soil profile $d = \frac{FC-PWP}{100} \times BD \times Soil\ Depth$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandy</td>
<td>5 – 10</td>
<td>2 – 6</td>
<td>1.5 – 1.8</td>
<td>50 – 100</td>
</tr>
<tr>
<td>Sandy-loam</td>
<td>10 – 18</td>
<td>4 – 10</td>
<td>1.4 – 1.6</td>
<td>90 – 160</td>
</tr>
<tr>
<td>Loam</td>
<td>18 – 25</td>
<td>8 – 14</td>
<td>1.3 – 1.5</td>
<td>140 – 220</td>
</tr>
<tr>
<td>Clayey-loam</td>
<td>24 – 32</td>
<td>11 – 16</td>
<td>1.3 – 1.4</td>
<td>170 – 250</td>
</tr>
<tr>
<td>Clay</td>
<td>32 - 40</td>
<td>15 - 22</td>
<td>1.2 – 1.4</td>
<td>200 - 180</td>
</tr>
</tbody>
</table>

Source: Handbook of agriculture, 1987, Indian Council of Agricultural Research

Water availability and crop growth proceeds uniformly from the field capacity to a certain critical point beyond which crop growth decreases rapidly till the permanent wilting point is reached. This view holds good for most of the seasonal field crops like paddy, wheat, mustard seed, pulses, vegetables and alike crops maturing up to the seed stage.

The effects of the crops and the climatic factors on the availability of soil water can also be significant. The responses of crops to the soil water are ultimately reflected through the plant water status and the atmospheric condition like aridity or humidity acts as the primary driving force for the absorption of moisture for the soil. A given crop losses water at different rate under different conditions of evaporative demands of the climate.

For most crop plants, except paddy the ideal soil for irrigation is that which is deep, without any water table has high water holding capacity, infiltration of rate and permeability and low salt content. The loam and clayey loam soils are generally good soils for irrigation. Since the run off, the number or frequency of irrigation necessary and the investment for drainage are low as compared with those in the case of other soils. Any soil can be put under irrigated agriculture permanently but only with due care and caution became on certain soils it may be beyond economic limits. The heavy soils of a need surface as well as sub-soil drainage the light sandy soil involves a high application of costly inputs besides a considerable wastage of water.

In the case of paddy the soils with low percolation rates are ideal for economising on water, land submergence has been found to be a beneficial practice of obtaining high rate of
productivity. But during the submergence huge quantities of water as high as 60% to 70% are lost through deep percolation. Nearly half of the water resource are diverted to paddy alone. The proper selection of land for growing paddy is therefore vital for utilizing water resources efficiency and economically.

Soil water system and suitability of soil for irrigation can best be understood with the help of the spatial distribution of different soil types after considering the geological and textural aspects. From the geological point of view four different types of soils can be observed, like

(a) Red soil

(b) Lateritic soil,

(c) Gondwana soil and

(d) Rajmahal flat

(a) Red Soil:

The ancient crystalline and metamorphic rocks on meteoric weathering have given rise to the red soil. The colour of the soil is due the wide diffusion of iron rather than to a high proportion of it. The soils grade from poor thin gravel and light coloured verities of the plains and valleys. They are generally poor in nitrogen phosphorous and humus. These soils are poor in lime, potash, iron oxide and phosphorus. Red soil has been found under forest vegetation. Morphologically the red soils can be divided into two broad sub-groups i.e. red-loam characterized by argillaceous soils with a cloddy structure and the presence of only a little concreetous materials, and the red earth where the top soil is loose and friable and rich in secondary concreetous materials. In this region the red soils are the transported soil from the hills of the Chhotanagpur Plateau.

The red soils in the Sriniketan-Santiniketan Planning Area is found extensively on the southern, east northern part of the region but it is not at all observed in the eastern and central parts of the region.
There are 54.76% of the total villages which have the coverage under red soil. Out of these villages where moderate to high extent of contour height is observed these villages mostly have moderate absolute relief and relative relief but small dissection index. All these villages have either moderate or higher extent of average slope. Among the above mentioned
villages covered by red soil, large number of villages have low depth of water table. And
these villages are extensively covered by sandy loam clayey loam and sandy soils. These
villages either have large or small proportion of net irrigated area which are irrigated either in
large or small proportion by canal and tank sources.

Out of the above mentioned villages either small or large proportion of land is
considered as net sown area in several villages. Among them large proportion of area under
many villages are devoted under aus paddy, aman paddy and boro paddy crops. However,
boro paddy is not cultivated at all in many villages. Also, wheat, potato, vegetables and
pulses crops are not cultivated in many villages of this region. However, in some villages
either larger or smaller proportion of land is devoted under wheat, moderate proportion of
land under potato, small proportion of land under mustard seed, vegetables and pulses crops
are cultivated very rarely.

The land concentration ratio of these villages are considerably high indicating that
very few large farmers are not only holding large chunk of agricultural land but also
influencing the agricultural developmental planning in their favour.

(b) Lateritic Soil:

Laterite is a formation peculiar to India with an intermittently moist climate. It is a compact
to vesicular rock composed essentially of a mixture of the hydrated oxide of aluminium and
iron with small amount of magnesium oxide. It is derived from the atmospheric weathering of
several types of rock. Under the monsoon conditions of alternating wet and dry season. The
siliceous matter of the rock is leached away almost completely during weathering.

The laterite may become broken off and be carried to lower levels by the action of
streams and when redeposited at lower levels may become cemented again into a compact
mass by the segregative action of the hydrated oxides including sand grains of quartzes and
other materials. Thus, there are high level laterites resting on the rocks at whose expense they
have been formed and the low level laterites formed in the usual way of detrital deposits.

All lateritic soils are very poor in lime and magnesium and deficient in nitrogen.
Occasionally, P_2O_5 may be high probably being present in the form of iron and phosphate but
K_2O is absent. There is occasionally, a higher content of humus.
On the lateritic soils, at lower elevations paddy is grown. The soil is rich in nutrients and contains 10 to 20% organic matter. The pH is generally low. In these lateritic soils the SiO₂ and Al₂O₃ ratio of the clay fraction is quite high. The percentages of k₂O, P₂O₅ and N are low, showing considerable leaching and washing out of the substances as a result of chemical weathering.

Lateritic soil is found in 19.05% of the total villages which are extended on the western flank villages of Sriniketan-Santiniketan Planning Area. In the rest parts of this region lateritic soil is absent.

The villages which are covered by lateritic soil have higher contour height with higher absolute relief, moderate relative relief and low dissection index. However, the average slope remains either moderate or low.

The same villages have low depth of water table. Texturally these villages are covered by sandy-loam, clayey, loam and sandy soils.

These villages have large proportion of net irrigated area which are largely irrigated by canal and have small proportion of tank irrigated areas.

The above mentioned villages have smaller proportion of net sown area where moderate to small proportion of land is cultivated under aus paddy but large proportion of land is devoted under aman paddy but boro paddy is cultivated rarely subjected to the availability of water. Small proportion of area is devoted under wheat, potato and mustard seed crops and vegetable and pulses are cultivated in very few villages on very small proportion of land.

The land concentrations are either high or moderate or low indicating that in some villages very few big farmers own large amount of landholdings, whereas, in other villages land is more or less equally distributed among the farmers belonging to different classes of landholdings.

(c) Gondwan Soli:

The concept of “Gondwana landscape” was defined by Fairbridge (1968) as an “ancestral landscape” composed by series of once planned remnants” that “records traces of older plantation” episodes, during the “late Mesozoic (locally Jurassic or Cretaceous)”. Their genesis is related to extremely humid and warm paleoclimatic of “hyper-tropical” nature,
with permanently water saturated soil, or perhaps extreme paleo-monsoonal climates, with seasonal and long term cycle fluctuations, from extremely wet to extremely dry. Deep chemical weathering is dominant geomorphological process. The weathering products are clays kaolinite, pure quartz and other silica from sand, elimination of other minerals and duricrust formation, such as ferricretes (iron), sileretes (silica) and calcretes (calcium carbonate).

Gondwana soil spreads over 19.056% of the total villages of this region which are found on the southern part of this region and along the left bank of the River Ajoy.

These Gondwana soil covered villages are very low contour height and very low absolute relief, moderate relative relief and moderate to low dissection index. All these villages have very low and mild slope of the terrain.

These Gondwana soil covered villages have covered by sandy loam, clayey and loam soils. Besides, these villages have either larger or smaller depth of water table.

The above mentioned villages have either moderate or small proportion of net irrigated area which is irrigated in small proportion by canal and tank sources.

These villages have moderate and larger proportion of net sown area, where small proportion of land is devoted under all paddy and small and medium proportion of land are devoted under aman paddy and small proportion of land is cultivated under boro paddy where irrigation is available. Wheat crop is grown either in large proportion or small proportion in some villages, whereas, potato, vegetables and mustard seed are cultivated in large proportion of land and pulses crops are rarely cultivated in very few villages.

The land concentration ratio is quite large and medium indicating that very few big farmers hold larger amount of landholding and thus influence the agricultural developmental planning in these villages.

(d) Rajmahal Flat:

There are only 7.14% of the villages of this region that are covered by Rajmahal Flat soil. This is available in a small pocket of the area located at the eastern part of the region.
In these three villages the contour height is either high or moderate or low. The absolute relief is small but the relative relief and dissection index are medium and these Rajmahal flat soil covered area has very low slope of terrain.

The above mentioned villages have very low depth of water table which are extremely covered by sandy, sandy-loam, clayey, loam and moram soil.

These villages have very small proportion of net irrigated area where canal provides irrigation over a small proportion of land. However, tank provides irrigation in larger proportion of area in one third of the villages.

In the above mentioned villages moderate proportion of net sown area is found which are devoted under moderate proportion of land under Aus paddy, whereas, larger proportion of land is devoted under amon paddy and small proportion of land is devoted under boro paddy, wheat is cultivated in moderate to small proportion of land in the villages. Potato and mustard seed are cultivated in small proportion of land, vegetables are largely cultivated in one village whereas, pulses are cultivated in small proportion of land in one village.

The land concentration ratio of these villages are either high or moderate indicating that very few big farmers own considerable amount of land ownership.
10.2 Texture:

After discussing soil types according to their geological formations it is utmost necessary to find out the textural characteristics of different soil types. From the textural point of view the soil can be classified into (a) heavy soil, (b) medium soil and (c) light soil. Heavy soil includes clayey soil, medium soil includes loamy soil and light soil includes moram, sandy loam and sandy soils.
(a) Heavy Soil:

(i) Clayey soil:

Clay soil is one of the heavy soils of the region which is very much sticky in nature. Out of 42 villages these soils spreaded over 40 villages i.e. 95.24% of the total villages. These clay soil covered villages have larger proportion of area which have high average contour height. Besides considerable area exists with moderate and low extent of average contour height. Likewise, absolute relief in most of the cases is medium in nature, however, low and high absolute relief is also predominant in different villages. Set against this, there are considerable number of villages where relative relief is of moderate order. However, the dissection index of these villages is considerably low. Therefore, it has given rise to low slope in larger number of villages followed by medium and larger slopes in relatively smaller number of villages. In the above mentioned 40 villages in larger number of villages depth of water table is very low. These clay soil covered areas are also covered with red soil to a considerable extent from the point of view of geology. Besides large number of villages are also covered by sandy, loamy and sandy loamy soils. In the above mentioned villages large number of village have considerable proportion of net irrigated area which are irrigated mainly by canal. However, there are large number of villages which are irrigated by tank, although to a small proportion. As far as land use and cropping pattern are concerned out of all the 40 villages one third each of the villages have either larger or moderate proportion or small proportion of net sown area which are either cultivated under aus paddy either to a moderate extent or high and small extent. Set against this, aman paddy is largely or in small proportion is cultivated in considerable number of villages. Boro is not cultivated in large number of villages; however, in very few villages it is cultivated subjected to the availability of irrigation. During winter season wheat crop is cultivated in small proportion in some of the villages followed by potato crop which is cultivated in moderate proportion and mustard seed crop is cultivated in small proportion in different villages. Vegetables and pulses crops are rarely cultivated in a very few villages.

50% of these villages have very high concentration land ratio where small number of big farmers own larger amount of landholdings, hence they influence the agricultural developmental planning in these villages.
(b) Medium soil

(i) Loamy Soil:

Map: 19

Loamy soil is one of the medium soils of the district. This soil is available in 36 villages i.e. 85.71% of the total villages. This soil is spread all over this region except few pockets on the central and eastern parts of the area. Loamy soil is the most fertile soil in respect of organic constituents. This soil is very much favourable for the utilization of Kharif, winter and pre-kharif crops. Therefore, multiple cropping can be practiced over this kind of soil. The entire Sriniketan-Santiniketan Planning Area, therefore, is covered by most favourable loamy soil.
Out of the 36 villages where loamy soil covers the terrain. Considerable number of villages have higher average contour height. These areas have low, high and, moderate absolute relief, which are divided into one third of each of the total villages. Besides, considerable amount of area has moderate relative relief and considerable number of villages have low dissection index. However, the average slope of the region is quite low indicating that the entire area is having monotonous levelled topography. The above mentioned villages have very low depth of water table and from the geological point of view most of the villages are covered by red soil. However, from textural point of view, the villages are covered by sandy, clayey and sandy loam soils. All these villages covered by loamy soils have larger proportion of net irrigated area which is irrigated largely by canal. However, there are substantial number of villages with small proportion of irrigated area where canal irrigation prevails. These villages have very small proportion of tank irrigated area. Among the above mentioned loamy soil covered area most of the villages have either moderate or small proportion of net sown area where aus paddy is cultivated on moderate proportion of land in these villages. Aman paddy is cultivated largely and in small amount in several villages. Boro paddy is not cultivated in a large number of villages, however, there are very few villages where boro paddy is cultivated in larger spatial extent. As far as rabi crops are concerned, wheat crop is cultivated in small amount in several villages and potato is either cultivated in larger or moderate or smaller amount in several villages. Mustard seed is cultivated over smaller spatial extent in several villages and vegetable crops are also cultivated largely in a very few number of villages. Same fact holds good in pulses crops also.

Most of the villages have high land concentration ratio indicating that very few big farmers own larger amount of landholdings and influence the agricultural developmental planning to a considerable extent.

(c) Light soil

(i) Sandy-Loam Soil:

Sandy-loam soil is found in different proportion in 100% of the villages in Sriniketan-Santiniketan Planning Area. Out of the total villages large number of villages have higher average contour height. Besides, these villages have moderate to lower extent of absolute relief, moderate extent of relative relief and smaller extent of dissection index. The average slope is very low in most of the villages indicating almost levelled terrain.
These villages have very low depth of water table which are covered geologically by red soil. These villages are also covered by sandy, loamy and clayey soils.

Out of the total village considerable number of villages have larger proportion of net irrigated area which are irrigated considerably by canal source. However, tanks provide irrigation to a smaller proportion of land in these villages.

The land use and cropping pattern indicate that almost one third of the villages have either small proportion, moderate proportion or large proportion of the land s as net sown area. Aus crop is cultivated over moderate and small proportion of land, whereas,
aman paddy is cultivated either on considerable proportion or small proportion of land in these villages. Boro paddy is rarely cultivated in a few number of villages subjected to the availability of irrigation. Wheat crop is cultivated in small proportion, potato is rarely cultivated in a few farms and mustard seed is cultivated in small proportion of land in these villages. Vegetables and pulses crops are rarely cultivated.

The land concentration ratio is quite high in most of the villages where small number of big farmers own large amount of land ownership and thus have control over the agricultural developmental planning of these villages.

(ii) Sandy:

There are 59.52% of the total villages of the Sriniketan-Santiniketan Planning Area is covered by lighter sandy soil. This soil has larger pore spaces through which considerable
amount of water get percolated. The accretion process is carried on in better manner but this soil has very poor water holding capacity. Generally this soil has higher temperature. Therefore, is not considered favourable for the utilization of higher water consuming crops. This sandy soil covers the entire region except the southern part of the region and a small pocket on the eastern fringe of the area.

Out of these 25 villages large number of them have higher contour height and these villages have higher absolute relief, moderate relative relief and low dissection index. But the entire region is having higher extent of slope on the terrain. Out of the above mentioned villages large number of them have very low depth of water table. These villages are covered by red soil to a large extent and from texture point of view these villages are covered by loam, clay and sandy loam soils.

These villages have however very small proportion of net irrigated area which are irrigated by canal in very small proportion. Tank irrigated areas are also minute in these villages.

Out of the above mentioned villages covered by sandy soils, most of them have very small proportion of net sown area. Out of them some villages have lesser proportion of area devoted under aus paddy, aman paddy and boro paddy. Although, Boro paddy is not cultivated in large number of villages. Wheat crop is cultivated in small proportion in large number of villages. Potato crops is cultivated either in small or medium proportion in several villages. However, it is not cultivated in considerable number of villages. Mustard seed is cultivated in small proportion in large number of villages, whereas, vegetables and pulses crops are not cultivated at all in a considerable number of villages. However, these are cultivated in small proportion in several villages.

The land concentration ratio are of higher order in these sandy soil covered areas, so that, a few big farmers can own larger amount of landholdings and develop their agricultural economy to a significant extent.
(iii) Moram:

There are 42.86% of the villages which are covered extensively by moram soils. These soil spreads over a large chunk of area extending in the entire north-eastern part, western part and southern part of Sriniketan-santiniketan Planning Area. However, on the north-western, central and south-eastern parts of this area this is very much absent.

Therefore, moram soil covers 42.86% of the total villages. Out of these villages there are considerable number of villages where high or moderate extent of contour height is observed. These villages have moderate extent of absolute relief, high and moderate
extent of relative relief and small extent of dissection index. The average slope is very mild or low.

These villages have larger depth of water table and from the geological point of view most of these villages are covered by red soil. However, from textural point of view, these villages are covered extensively by sandy loam, clay, loam and sandy soils.

The above mentioned villages have either small or large proportion of net irrigated area in several villages which are irrigated largely and moderately in several villages by means of canal source. However, small proportion of tank irrigated areas are found in several villages also.

Among the above mentioned villages there are one third of the villages which have either large or moderate or small proportion of net sown area. These villages have small to moderate proportion of coverage under aus paddy but larger proportion is devoted under aman paddy, boro paddy is rarely cultivated in very few villages subjected to the assurance of irrigated water. Wheat crops cultivated in small proportion in some villages, however, it is not cultivated at all in several villages. Same fact also holds good in case of the potato crop. Mustard seed crop is cultivated either in small proportion or large proportion in certain villages, whereas, vegetables and pulses crops are cultivated not much extensively in several villages.

In large number of villages the farmers have large land concentration ratio indicating that a few big farmers have accumulated large amount of landholdings. Thus, they have strong grip over the agricultural development planning in all the villages.

10.3 Groundwater Resource:

Water resource can be of two types, viz. Surface water and groundwater. It has been already discussed about the surface water resource by means of net irrigated area, canal and tank irrigated areas. But there is another source, i.e. groundwater resource. Groundwater resource means availability of water resource in shallow, medium and dip aquifers. From these aquifers tube wells can be dug or submersible machines can be installed and these tube wells and submersibles pull out the groundwater at the surface and irrigation can be made possible. However, in this region in spite of the availability of groundwater resource tube well irrigation is absent. So that till today the groundwater resource is not tapped at all. However,
due to the seepage of surface water resource groundwater resource is enriched. Due to this enrichment of groundwater resource there will increase in the intensity of overland flow and under drainage of water logging conditions. Therefore, this kind of situation may cause flood and water logging condition due to less seepage of water. The water table is raised very quickly and as the water table reaches capillary zone or near to the surface it will cause successive and extensive flood and water logging condition because recharge of the groundwater resource is taking place but discharge is absent.

In some villages the depth of the water table is as low as only 8 metres, whereas, in some villages it is as high as 12 metres. Within these two extreme ranges all the villages exist. There are 59.52% of the total villages where the depth of the groundwater resource is
very low, i.e. 8 to 10 metres. Besides, 21.43% of the total villages where the depth of the water is medium in nature and there are 19.05% of the total villages where the depth of the water table is relatively high, i.e. in between 11 and 12 metres. Therefore, it has been observed from the survey in most of the villages the depth is very shallow i.e. close to the surface, where digging of tube well is much cheaper.

The village with shallow depth of water table are located on the eastern, southern and western parts of the region, whereas, the villages with higher depth of water table are confined to the south-western, northern and central parts of the region and villages with medium depth water table are located around the villages with higher depth of water table of this region.

There are 19.05% of the total villages having higher depth of water table. These villages have high and moderate extent of contour height where absolute relief is moderate and relative relief are either moderate or high. Dissection index is lower and the slope of the terrain is considerably mild.

From geological point of view, all these villages are covered with either red or Gondwana soils and from textural point of view all these villages are covered by sandy loam, clayey and loam soils.

These high water table villages have very small proportion of net irrigated area; however, these are irrigated in lower and medium proportion by canal source and very small proportion by tank source.

The above mentioned villages have considerable amount of net sown area which are cultivated in small proportion by aus paddy, aman paddy and boro paddy is cultivated rarely subjected to the availability of irrigation. Wheat crop is cultivated in small proportion but potato is cultivated either in large or moderate proportion mustard seed is cultivated in large proportion; vegetables and pulses are either not cultivated or rarely cultivated in a few villages.

The land concentration ratio is either higher or moderate indicating that there are few farmers who own larger amount of landholding thus, control the agricultural developmental planning to a significant extent.
There are 21.43% of the villages having moderate depth of water table which have higher contour heights and higher absolute relief, moderate relative relief and low dissection index and the slope of the terrain is either very low or mild and larger in some villages.

In the above mentioned villages from the geology point of view most of the villages are covered by red soil and from textural point of view these villages are covered by sandy loam, sandy, clayey and loamy soils.

All these village shave larger proportion of net irrigated area which are irrigated in smaller proportion by canal in some villages and in some this proportion is quite large. Tank irrigation is available either in very small proportion or are absent in some villages.

These villages have one third each with large, moderate and smaller proportion of net sown area. These villages have either moderate or larger proportion of area covered under aus paddy, either smaller or larger proportion of area devoted under aman paddy and larger proportion of area is devoted under boro paddy where irrigation is available during pre kharif season. Besides, in many villages Boro paddy is not cultivated, wheat crop is cultivated in small proportion in some villages and in some villages it is not practiced. Potato crop is not cultivated in many villages, however, in few villages it is cultivated either in larger or moderate proportion. Mustard seed is cultivated in small proportion; vegetable and pulses crops are either largely cultivated or are absent.

The land concentration ratio in these villages are either large or small indicating that in larger land concentration ratio villages a few big farmers own larger amount of land. Whereas, in the low land concentration owned villages the land are all more or less equally distributed among the farmers. So that the agricultural developmental planning implementation is also equally distributed among all the farmers in the later group and this is just the opposite in the case of the former villages.

There are 59.52% of the total villages of this region which have very low depth of water table. These low depth water table villages have either moderate contour height or high and low contour height of the terrain. These villages have low absolute relief, moderate to high relative relief and low to moderate dissection index. However, the general slope of the terrain is very much mild.
These low depth of water table villages are covered by red soil to a larger extent although a few villages among them are also partially covered by lateritic, Gondwana and Rajmahal Flat soils. These villages are covered texturally by sandy loam, sandy, clayey and loamy soils.

The above mentioned villages have either larger or smaller proportion of net irrigated area. Some villages which are either largely or in small proportion irrigated by canal source and some villages are favoured by small proportion of tank irrigated area. Although tank irrigation is partially available in some villages, however, in large number of villages tank irrigation is absent.

The above mentioned villages with very low depth of water table have very small proportion of net sown area. Which are devoted to moderate proportion of aus paddy, large proportion of aman paddy and boro paddy is rarely cultivated in very few villages where irrigation is available. Small proportion of area is devoted under wheat crop, potato crop and mustard seed crop.

Besides these crops are absent in many villages of this kind. Besides, vegetables and pulses crops are also not cultivated in many villages. However, in some villages these are cultivated either in larger or smaller proportion.

These villages have either high or moderate extent of land concentration ratio indicating that these villages have small number of big farmers who own larger amount of landholdings, hence influence significantly on the agricultural developmental planning of these villages so that, they earn larger amount of profit and benefit from agricultural and water management practices.

In conclusion it can be said that soil characteristics play an important role in application of soil amendments, pesticides, fertilizers and water. Irrigation strategy for clay-based soils is much different than the strategy for sand based soil.

When it comes to irrigation many growers questions how much, how long and how often they need to irrigate. The answers usually involve a combination of soil character, its plant growth stage and weather, however, how fast to apply water is based solely on soil type.

Paying attention to soil type and how it should be irrigated will make water applicators more efficient and more environmentally safe (Goldy R., 2012).