Figure 1: Study area map

4. Material and Methodology

For doing any research work various kinds of data are required for fulfill our research purposes. Therefore various kinds of data were used in study which is briefly described below:

Satellite Data

Remote sensing data is the basic data source for Horticulture Fruit Crops mapping of the study area. World view-2 &Indian Remote sensing satellite (IRS-P6) LISS-III data is used for the present study applying onscreen visual interpretation and digital analysis techniques respectively. World view-2 sensor provide 2 meter spatial resolution data with 8 bands while LISS-III provide 24 meter spatial resolution data Green, Red, NIR and SWIR bands with 24 days revisit capability.

Ancillary Data

1. Administrative boundary (district & blocks).
2. Statistics at district & blocks level of Dept. of Horticulture.
3. In season collected ground truth data.

Software Used

Geomatica 10.3: Geomatica10.3V software is used for the purpose of image processing.

ERDAD IMAGINE 9.1: In this study ERDAS was applied in importing, image subseting, mosaicing, Geo-referencing and image rectification.

ARC-GIS 9.3: This software was used for visual interpretation and map composition.

MS Office 2007: For the current study we use Microsoft Office in Report & Graph generation.

5. Methodology

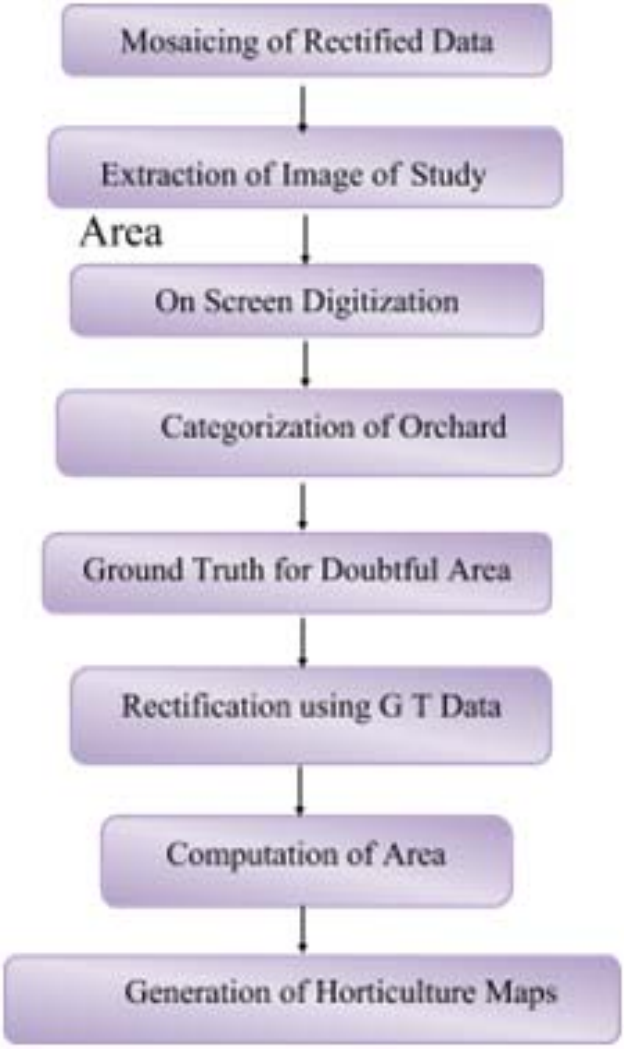


Figure 2: Methodology flow chart of visual interpretation

6. Result and Discussion

Horticulture fruit crops mapping and plantation mapping was done for Hisar-II and Adampur blocks of Hisar district. Different types of available data such as World View-2, 8 band multispectral data having spatial resolution 2 meter and IRS-P6 LISS-3 multispectral data having spatial resolution 24 meter were explored to assess the best dataset for such type of studies. Different analysis approaches such as onscreen visual interpretation using high resolution World View-2 data and hybrid approach using medium resolution IRS LISS-III data explored and the results from these approaches were compared.

Horticulture Fruit Crops Area Mapping Using On Screen Visual Interpretation Approach

Geo-referenced World View-2 multispectral data was mosaiced and study area blocks were extracted after overlying administrative boundaries. Digital data was displayed and horticulture fruit crops area was delineated. Different enhancements techniques were used to identify horticulture fruit crops. Citrus is the major crop of the study area followed by Guava, kinnu and anola. As the area of Guava, kinnu and anola is insignificant and

spectral signatures are similar to Citrus hence cannot be separated. Block wise area of horticulture fruit crops given in Table 1 and in Figure 3**.** Spatial distribution of horticulture fruit crops were depicted in Map 1.

Table 1: Horticulture Fruit Crops Area in Different Blocks of Hisar District

%RD	Area in Ha. (DOH)	Area in Ha. (RS)	Horticulture Fruit Crops Area
-18.44	620.70	506.23	Adampur
-1.093	450.81	445.88	Hisar-II
-11.14	1071.51	952.11	Total

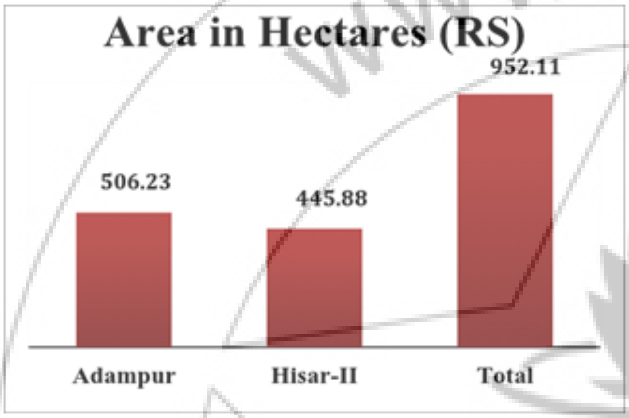
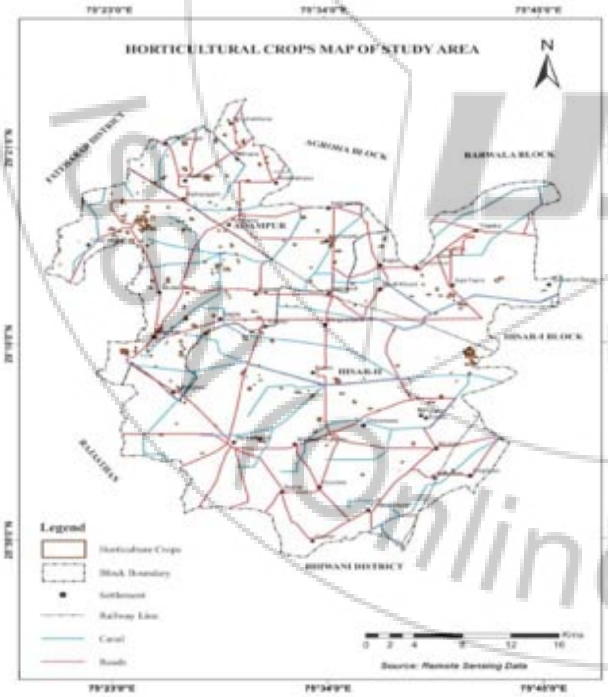


Figure 3: Horticulture Fruit Crops Area in Different Blocks of Hisar District



Map 1: Horticulture Fruit Crops Map of Study Area

The total horticulture fruit crops area in the study blocks is 952.23ha. Concentration of Horticulture fruit crops area is more in Adampur block having 506.23 ha. Area is significantly higher as compared to Hisar-II 445.88 ha. RS based horticulture fruit crops area at block level compared with the area provided by Dept. of Horticulture (DOH) for the same year i.e. 2011. Remote sensing based area was found to be quite close with DOH estimates that show in table 2.

Table 2: Relative deviation of Horticulture Fruit Crops Area in Different Blocks

Area in Hectares (RS)	*Horticulture Fruit Crops Area*
506.23	Adampur
445.88	Hisar-II
952.11	Total

Total horticulture crops area is also categorized in two categories i.e. Young and Mature/Old crops. Young horticulture crops recorded 310.07ha while old crops area was slightly higher 642.04 ha. Out of total area67% area is under mature horticulture crops and 33% under Young horticulture crops. Category wise area is given in Table 3 and Figure 4 Spatial distribution of category wise area is depicted in Map 2.

Table 3: Area under Different Categories of Horticulture Fruit Crops in the Study Area

Area in Hectares (RS)	*Horticulture*
310.07	Young Horticulture Crops
642.04	Mature Horticulture Crops
952.11	Total Area

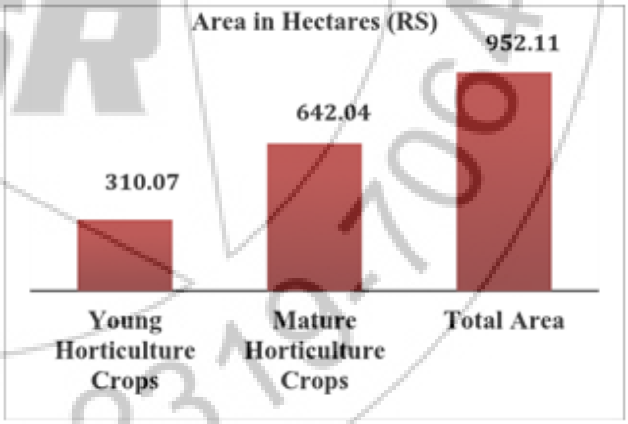


Figure 4: Area under Different Categories of Horticulture Crops in the Study Area

Map 2: Horticulture Fruit Crops Map of Study Area

Horticulture Fruit Crops Area Mapping Using Hybrid Approach

IRS-P6 LISS-3 multispectral data of February 07, 2011 was used for the mapping of Horticulture fruit crops using Hybrid approach. Hybrid approach consists digital classification for delineation of Horticulture fruit crops and onscreen visual interpretation of the areas for which the classes are not properly delineated. Digital data was geo-referenced and study area was extracted after overlaying administrative boundary. The non-agriculture mask and Normalized Difference Vegetation Index (NDVI) were generated for the extracted area. Different type of masks such as inside block, outside block and combined outside boundary were also generated for the area computation purposes. Complete enumeration approach and Iso-Data clustering classifier was used for the classification of extracted image by defining decision rules such as number of clusters, standard deviation etc. Horticulture fruit crops and associated features were identified using ground truth data collected .The mask of mixed classes was prepared and the image under the mask was reclassified and various classes were delineated. The reclassification process was done two times; even then some mixed classes area was left. The area of mixed classes was extracted and crop of interest were delineated using onscreen visual interpretation. Combined mask of Horticulture fruit crops was prepared and area statistics and maps were generated. The total horticulture fruit crops area for the study blocks derived using this approach is 717.53hectares, out of the total area 413.12 and 307.41 hectares area recorded in Adampur, and Hisar-II blocks respectively shows in table 4 and Figure 5. Spatial distribution of Horticulture fruit crops depicted in Map 5.7.RS based estimates of Horticulture fruit crops were compared with Dept. of Horticulture (DOH) estimates by computing per cent relative deviation. There are large gaps were observed in the area derived using hybrid classification approach.

Table 4: Horticulture Fruit Crops Area in Different Blocks of Hisar District

%RD(Hybrid Approach)	Area Ha(DOH)	Area Ha (Hybrid Approach)	Horticulture Fruit Crops Area
-33.44	620.70	413.12	Adampur
-33.84	450.81	298.23	Hisar-II
-33.61	1071.51	711.35	Total

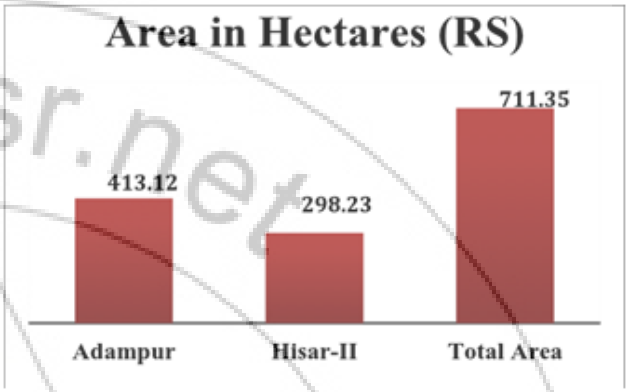


Figure 5: Horticulture Fruit Crops Area in Different Blocks of Hisar District

Map 3: Horticulture Fruit Crops Map of Different Blocks of Hisar District

7. Conclusion

Horticulture fruit crops mapping were done for Hisar-II, and Adampur blocks of Hisar district. Different types of available data such as World View-2, 8 band multispectral data having spatial resolution 2 meter and IRS-P6 LISS-3 multispectral data having spatial resolution 24 meter were explored to assess the best dataset for such type of studies. Geo-referenced World View-2 multispectral data was mosaiced and study area blocks were extracted after overlying administrative boundaries. Digital data was

displayed and horticulture fruit crops area was delineated. Different enhancements techniques were used to identify horticulture fruit crops. IRS-P6 LISS-3 multispectral data of February 07, 2011 was used for the mapping of Horticulture fruit crops using Hybrid approach. Hybrid approach consists digital classification for delineation of Horticulture fruit crops and onscreen visual interpretation of the areas for which the classes are not properly delineated.

1. The total horticulture fruit crops area in the study blocks is 952.23ha. Concentration of Horticulture fruit crops area is more in Adampur block having 506.23 ha. Area is significantly higher as compared to Hisar-II 445.88 ha.
2. Total horticulture crops area is also categorized in two categories i.e. Young and Mature/Old crops. Young horticulture crops recorded 310.07ha.While old crops area was slightly higher 642.04 ha.
3. Out of total area 67 % area is under mature horticulture crops and 33% under Young horticulture crops.
4. RS based estimates of horticulture fruit crops area was compared with Dept. of Horticulture (DOH) estimates by computing per cent relative deviation (%RD). RS based estimates are found to be quiet close with DOH estimates of same year i.e. 2011. RS based area under estimated by -11.44% as compared to DOH estimates.
5. The total horticulture fruit crops area for the study blocks derived using hybrid approach is 717.53ha.out of the total area 413.12, and 307.41ha. area recorded in Adampur, and Hisar-II blocks respectively.
6. RS based estimates of Horticulture fruit crops were compared with Dept. of Horticulture (DOH) estimates by computing percent relative deviation. There are large gaps were observed in the area derived using hybrid classification approach.RS based area under estimated by -33.61% as compared to DOH estimates.

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