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PROPOSED CROPPING PATTERN AND AGRICULTURAL WATER DEMAND IN NILWANDE LEFT BANK CANAL COMMAND AREA OF AHMEDNAGAR DISTRICT

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Abstract:- The agricultural sector is the largest consumer of water use in the command area. However, the main purpose of the most multi-purpose projects is to implement irrigation schemes for agriculture in the command area. As well as water used for domestic and industrial uses also in the command area. The rapid growth of population and expansion of agricultural area is escalating pressure on water resource in the command area. In such a situation, it is necessary to implement sustainable water management plan in all water use sectors. The sustainable water management includes, water demand calculation. It helps to insure the net availability of water resource and assess the utilization pattern in all sectors of the command area. Regarding same issues, the agricultural water demand of the left bank canal command area has been calculated with the help of suggested proposed cropping pattern in the Nilwande left bank canal command area.

Keywords: *Water Management, Water Need, Utilization, Cropping Pattern, Command Area.*

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I INTRODUCTION

Planning and management is needed to make optimum use of available water for irrigation and to maximize the area under irrigation. Agricultural water management has been a challenge due to differentiate precipitation, soil types, cropping patterns and other socioeconomic factors (Dawod, 2013). The agricultural water need depends on the crop water requirement (CWR) and actual water available for the crop (Frenken, 2012). The estimation of CWR is the fundamental need for irrigation planning in the command area (Dhamge, 2012). The crop water requirement is affected by the climatological factors i.e. precipitation, temperature, wind velocity, sunshine, and radiation. In addition, the CWR varies according to the moisture retention capacity of soil and the stage of crop growth (FAO, 2005). The estimation of water requirement for various crops is an essential need for irrigation planning, and it depends on the cropping pattern of the command area.

The Cropping pattern of the region is the proportion of the area of cultivable land under a variety of crops at a time. The cropping patterns of agricultural region have been affected by a number of physical factors i.e. soil, terrain profile, rainfall, temperature and socioeconomic factors i.e. demography, literacy, irrigation facilities, transport, technology, market and method of production (Vaidya, 2007). According to Plamen (1996), Sarah (2000), White (2010), and Guma (2011) irrigation plays a vital role in changing the cropping pattern as compare to other factors.

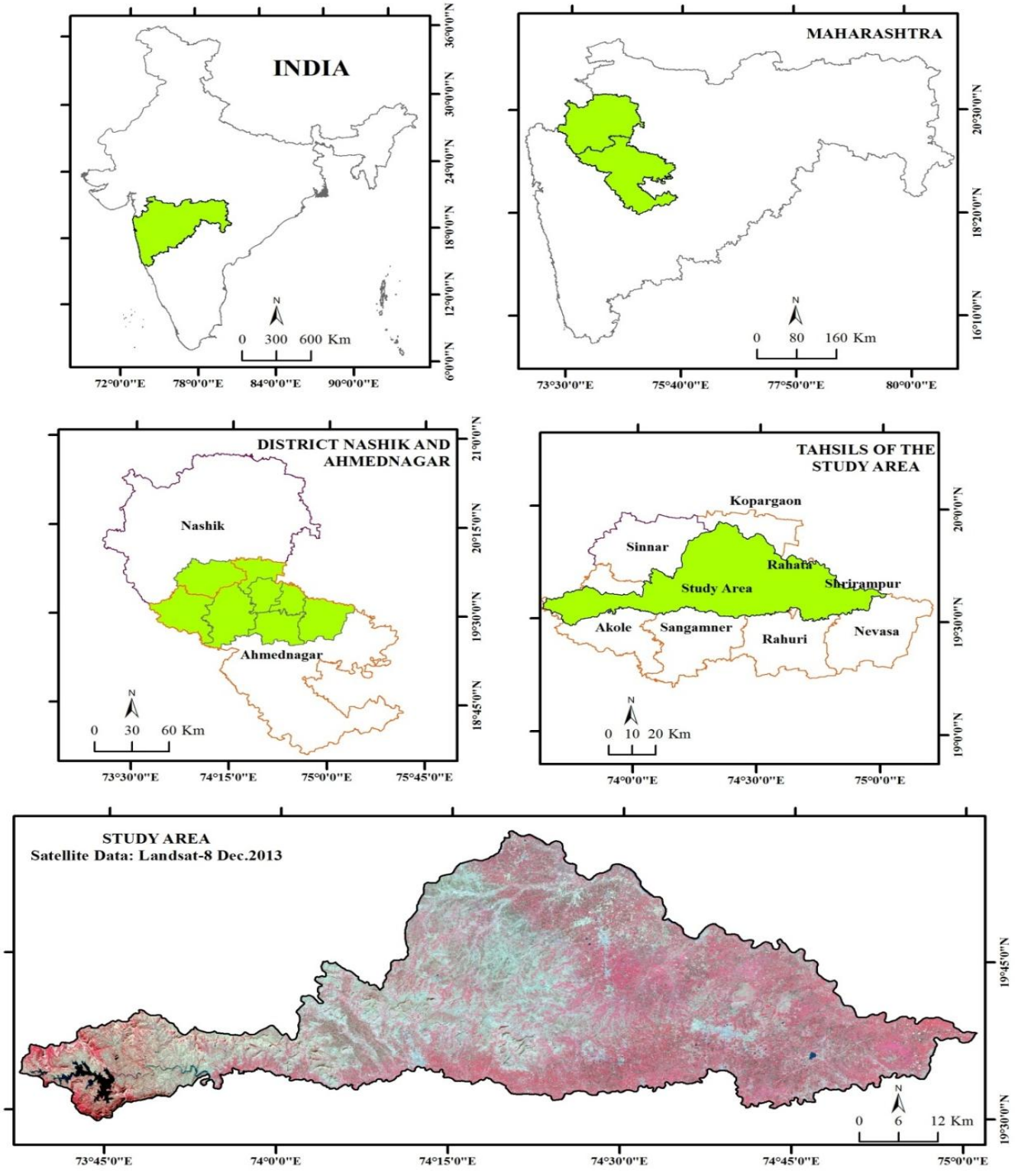

Figure 1.1 Location Map of Study Area

Farmers have developed their own cropping patterns associated with their environmental condition and available resources. Many researchers viz. Rao (1985), Shaikh (1993), Mony (1995), Ghatak (1997), Pandya (2000), Dalimbe (2012), and Dokhe (2013) have stated that, the irrigation facilities and modern inputs like hybrid seeds, chemical fertilizers and pesticides have changed tremendously the cropping pattern in the different part of the country. Therefore, present research paper evaluates the proposed cropping pattern of Nilwande left bank command area and calculating the agricultural water requirement of the command area.

II STUDY AREA:

Geographically, the study area lies between 19˚ 26' 32.59" north to 19˚ 57' 33.55" north latitude and 73˚ 35' 30.48" east to 75˚ 02' 17.22" east longitudes including the part of Ahmednagar and Nasik districts of Maharashtra. The left bank canal comprises maximum areas of Ahmednagar district, including Akole, Sangamner, Rahata, Shrirampur, Kopargaon and only Sinnar tehsil of Nasik district.

III DATABASE AND METHODOLOGY:

Proposed Cropping Pattern

The Nilwande dam project constructed for the maximum benefits to the scarcity affected area from the Ahmednagar and Nashik districts by the government of Maharashtra. Considering the need for irrigation water in the command area and water storage capacity of the dam, Agricultural Department, Pune, Government of Maharashtra recommended the eight monthly two seasonal crop pattern for the command. There is no provision for hot weather crops, and perennial crops.

Table 1.1Proposed Cropping Pattern

Sr. No.	Season	Name of Crop	Cropping Pattern Percentage	LBC ICA Area in Ha
1	*Kharif*	Bajra	13	5705
2		Vegetables	3	1317
3		Fodder crops	2	878
4		Groundnut	2	878
5		Pulses	20	8777
	Total *Kharif*		40	17554
1	*Rabi*	Vegetables	2	878
2		Jowar (Maldandi)	8	3511
3		Hybrid Jowar	20	8777
4		Wheat	5	2194
5		Gram	25	10972
	Total *Rabi*		60	26332
Total (*Kharif* + *Rabi*)			**100**	**43886**

Source: Irrigation planning Report, Upper Pravara Project, Nilwande

Table 1.1 describes the proposed cropping pattern of LBC of Nilwande dam. The irrigation plan is divided into the two seasons, namely *Karif* and *Rabi* in the area under rain fed conditions. Table 1.1 indicates the season wise crops and their area in hectors. The total *Kharif* season covers 40 per cent area of total irrigable command area (ICA), and the *Rabi* Season covers 60 per cent area of the total irrigable command area. Hence, the left bank canal furnishes an agricultural water demand of the total 43886 ha irrigable command area.

***Karif* Season**

Generally in Maharashtra, there are three agricultural seasons. They are *Kharif* (Rainy season), *Rabi* (Winter) and Summer season. The period of the *Kharif* season start during mid June and July. It is seen that the monsoon rainfall in the month is 97.80 to 113.83 mm (Average 105.8 mm) in the command area. This rainfall can be considered just enough for soaking or for the purpose of land preparation for the *Kharif* crops as per suggested cropping pattern. During the month of June farmers sow *kharif* crops, according to the soil types. But, the statistics of the past few years show that during the *kharif* season, rain breaks up for many days after sowing. During the same period ground water level also deplete enormously. Irrigation has been planned for the LBC command area. During this period, it is important to supply an artificial water to crops. In some lean years or years of delayed monsoon the water supply can be met by the LBC system. In the proposed cropping pattern and irrigation planning the *Kharif* season has given 40 % weighted in irrigable land in the command area. The proposed Kharif season has five crops in planning, within that, Bajra 13% (5705 ha), Vegetables 3 % (1317 ha), Fodder crops 2% (878 ha), Groundnut 2% (878 ha) and Pulses 20% area will occupy of the total irrigable command area (17554 ha) in the season.

***Rabi* Season**

The *Rabi* season has given 60% weighted in the proposed irrigation planning. Generally, it is considered 15th October to 15th February in the year. During this season, soil moisture decreases rapidly and it becomes dry in the water scarce region. Some farmers sow some pulses crops (Chickpeas, Tur etc.) at an early period, but during the post maturity, there is not any source of irrigation, hence, the production is reduced by 50-60 percent of irrigated land. It is observed that, many times, there is not any crop grown by farmers. Water conservation and canal water have been planned for the drought-prone command area in *Rabi* season. The left bank canal is proposed to irrigate about 26332 ha area in *Rabi* season of the total irrigable command area (43886 ha). The proposed *Rabi* season has suggested the five crops in irrigation planning. The maximum shares are covered by gram crops (25%) in suggested cropping planning. It includes mainly cash crops like Chickpeas (*Harbara*) and *Tur*. After that, high yielding hybrid *Jowar* (20%), Maldandi traditional Jowar (8%), Wheat (5%) and Vegetables (2%) crops will be cultivated in the total 26332 ha area of the total ICA (43886 ha.) in Rabi season.

Calculation of Agricultural Water Demand

According to the irrigation planning report of The Upper Pravara Project Nilwande, the water requirement of crops in the LBC command area has been calculated by Modified Penman Method. The month wise weighted average rainfall values are calculated from an available data of the nine rain gauge stations, which are well spread in the LBC command area. The rainfall data from 1966 to 2005 is considered for the average rainfall from nine rain gauge stations, namely Akole, Sangamner, Khandala, Ozar, Shrirampur, Deolali, Rahuri and Rahata.

The values of potential evapotranspiration (PET) are taken as per the WAPCOS adopted for the Kukadi project of Ahmednagar station. These values have been computed by using the climatological data for ten years during 1962 to 1971 of the station at Ahmednagar as per following formula

PET = [WRn + (1-w) f (u) (ea -ed)] c (1)

PET-	Potential Evapotranspiration in mm
W-	Temperature related weighing factor
Rn-	Net Radiation in mm
f (u)-	Wind related function
(ea-ed)-	The difference between saturated vapor pressure at mean Air temperature and mean actual vapor pressure of air in mb
C-	Correction factor

The crop coefficient is the property of plants utilized in the predicting ET. The ratio between the ET observed for the crop and the standardized reference crop ET under the same condition is called 'crop coefficients'.

KC = ET ÷ ETo (2)

Where,

KC = Crop Coefficient

ET = Crop Evapotranspiration

ETo = Reference Crop Evapotranspiration

The net irrigation requirement (NIR) at the field has been worked out for each crop as per the suggested crop patterns in the command area as

NIR = [ET - ER] + PI (3)

Where,

NIR = Net Irrigation requirement

ET = Evapotranspiration (Calculated as Modified Penman Method)

ER = Effective Rainfall

PI = Pre-sowing Irrigation (mm)

IV DISCUSSION:

The month wise effective rainfall has been considered for calculating the each crop NIR. The effective rainfall is calculated as, the total rainfall minus the rain water infiltrated below the plants root zone and water flows over the surface that is run-off. The 80 per cent chances considered, against the 100 per cent use of rainfall of assurance rainfall while calculating the effective rainfall (EF). The effective rainfall is read from the graph of average monthly consumptive use against normally used monthly rainfall. The maximum water need on the basis of NIR has been calculated in M^3 (Cubic meter) per 100 hector irrigable command area, according to the suggested crops in the time period. According to the

NIR for root zone of each crop, the delta of the crop has been computed. The delta of each crop is calculated as the total quantity of water divided by the total irrigated area.

The net water requirement for agriculture of the Kharif and Rabi seasons is calculated 106399767.7 m3 / (3.76 TMC) as per Modified Penman Method. The overall irrigation efficiency of the Nilwande irrigation project is 42 %, according to the irrigation planning report of the dam. Hence, to fulfill the 3.76 TMC (42 %) water requirement at the root zone level, the canal head will be supplied with 8.95 TMC (100 %) water from the reservoir. After that, as per the suggestion of Water and Land Management Institute (WALMI), Aurangabad the total water requirement is reduced with the 20 per cent, due to the ET values estimated by Modified Penman Method is higher-15-20% than the measured by Lysimeter. Hence, the total water requirement of the left bank canal in the command area of the Nilwande dam for the suggested cropping pattern is 202666224.23 m3 (7.16 TMC) with the 42 % overall canal irrigation efficiency.

V CONCLUSION:

The total recharge will be available in the proposed left bank canal command area is 5613 Mcum (1.99 TMC). Therefore, the Net irrigation requirement (NIR) for 43886 hectare irrigation is calculated as total Gross irrigation requirement (GIR 7.16 TMC) minus available recharge (1.99 TMC) in the LBC command area, means the total actual agricultural water demand will be 5.17 TMC as per the suggested cropping pattern.

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