THESIS

DEVELOPMENT OF A SMALL SCALE IRRIGATED AGRICULTURE ON SUSTAINABLE BASIS FOR JOWHAR DISTRICT IN SHABELLE RIVER BASIN, SOMALIA

By

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ABSTRACT

Somalia, with a total area of 637660 km square, has cultivable area of about 8 million ha, which is only 13% of total area. The cultivated area is estimated to be 980,000 ha or 1.5% of the cultivable area. Only about 18 000 ha, which is 2% of cropland consisted of permanent crops. A fairly large water resource is available in the country. Its is very necessary to expand permanent cropping in the country by providing irrigation system on small to medium scale on productive lands. This study was undertaken to plan an irrigation system for a small area in Jowhar district in Shabelle River basin, which could be managed / operated directly by the farmers on sustainable basis. The study area was selected due to its good soil quality, hydrological conditions, and land use practice as current limited crop production under rainfed agriculture. No previous work related to irrigation system development was carried out for the selected study area, except that local farmers, depending upon the seasonal rainfall of the area, constructed some small service inundation canal. The selected study area is located near Mahaday Wayne rain gauge station, which has good record. The gross command area of purposed site is estimated to be 6430 ha.

Presently the area has low cropping intensity and poor crop rotation with farmers cultivating only sorghum and maize. Three cropping pattern was considered for the study area, based on two main seasons Gu and Der in relation to sustainable water supplies in the Shabelle River. The CROPWAT model was used to determine future irrigation and crop water requirements based on three purposed scenarios. However scenario one was selected as suitable scenario, which satisfied water availability, both best and worst

scenarios for achieving sustainability in the study area. Future cropping intensity was selected as 122 % (Gu = 72 %, Der = 50 %) with different crops as Banana (20%), Sorghum (12%), Sesame (15%), Pulses (8%), Groundnuts (10%), Beans (7%) in Gu season and Maize (12%), Sorghum (5%), Tomatoes (10%), Onion (8%), Citrus (10%) and Beans (5%) in Der season in consideration of community food farming habits and available water resources. However the actual future cropping pattern will evolve under prevalent / agronomic / hydrologic / social / marketing conditions in the area.

A suitable layout of main canal system along with drainage layout and farm roads was proposed for the study area considering NSL, to supply water for crops of the canal command area. The canal system will irrigate about 6422 ha down stream of Mahaday Wayne district. The system consists: one main canal, five distributary canals, (DR1, DR2, DR3, DR4, and DR5) and 53 No of watercourses. The main canal is about 16 Km long starting from near the riverbank. A large capacity (3.20 m^3/sec) low head (5 m) pump will lift the river water into Main Canal. The distributaries and watercourses are aligned to provide maximum command area. Net cropped area was determined after considering length and right of way of the canals, roads, and drains. The watercourse and field layout was proposed for a typical block of 2000 m by 500 m (gross area 100 ha, net cropped area = 95.8 ha) consisting of 100 fields (number 1 to 100) of 0.958 ha each. One main watercourse (L= 1.958 Km) and 10-branch watercourse (L= 10-.492= 4.92 Km) of 50 lps capacity will provide irrigation supplies to a typical watercourse command area.

The hydraulic design (Water Level, Bed level, Width, Depth) of branch watercourse was based on surface elevation of fields to be irrigated. The hydraulic design of main watercourse was selected to ensure water delivery into all branches. The watercourse cross section was selected as unlined trapezoidal with B≈D and side slope ½ H = 1V. The hydraulic grade of watercourse was selected as per site profile condition. Adjustable Orifice Semi-Module (AOSM) outlet was selected as watercourse outlet to provide requisite flow with 0.2 m operating head. The hydraulic design of distributary was based on hydraulic requirements (discharge and water elevation at head) of off-taking watercourses. Distributary cross section is unlined trapezoidal with B≈D and side slope of ½ H= 1V and hydraulic slope according to site elevation without any drop structure. A gated head regulator with working head of 0.2 m was provided for the distributary. The main canal was aligned as a contour canal with gravity flow. The water level in main canal was kept 0.4 m higher than in the distributary to ensure adequate flow into the distributaries at all flow conditions in main canal. The main canal is lined with cross section as trapezoidal with B≈D and side slope of 1.5 H= 1V. The irrigation application was taken as 70 % conveyance losses in watercourse were taken as 10 %. The conveyance losses of distributary and main canal were taken as 5 and 3 m^3/sec per million square meter of wetted perimeter, respectively.

Surface drainage was provided in study area, to evacuate rainfall runoff from high intensity tropical rainstorms. A collector drain is provided along lower command boundary to collect runoff from each watercourse command area and discharge into a main drain, which will ultimately drain into Shabelle River. The drainage system was

designed for drainage coefiecient of 1.2 l/s/ha. The collector and main drains are aligned adjacent t and along lower main watercourse and distributary, respectively.

Basin irrigation method was adopted for the study area for field irrigation; each field (98.3 m*98.1m) is divided into 2 compartments (each 49 m). Unit stream size of 1.02 l/s/m (total flow of 50 l/s admitted to one hectare) for cutoff time of 140 minutes will ensure target depth of 8.5 cm per irrigation with application efficiency of 97.3 %, storage efficiency of 100 % and distribution efficiency of 99.2 %.

For present study the irrigation operation is considered as whole day (24-hrs) supply with fixed supply rotation of seven days (1-week) in contrast of to present day only (8 hrs) irrigation practice in Somalia. . Seven-day rotation system is very flexible but ensures water supply to each farmer. Farmers are expected to adopt this irrigation mode once they realize the benefit of irrigated agriculture in the form of increased crop production. The pumping into main canal will vary each month according to cropped area and ET_o.

It's recommended to covert vast areas of Shabelle River Basin into irrigated agriculture with advantage of farmer based irrigation management. This way the socio-economic development of agriculture sector and food security for ever increasing population will be ensured and hence sustainable development will be achieved.