Green Business Plan

for establishing a

Wheat production farm with sprinkle irrigation system and protected with tree windbreaks

(TEMPLATE)

First and last name: _____

Date of birth: _____

Address: _____

Telephone: _____

Email: _____

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TOGETHER WITH

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1. Summary

The proposed business idea is to produce wheat, irrigated with sprinkle irrigation and protected with tree windbreaks for increasing the productivity of the farm, decreasing water consumption, and for improving environmental conditions including air quality and green areas for beneficial animals and insects, in other words, promoting ecosystem services such as carbon sequestration and pollination.

In Uzbekistan, impact assessments from the implementation of sprinkle irrigation systems for wheat production have shown increased yields of 25% to 300% with minimum gains of 25% in low productive soils. In addition, plantation of trees for windbreaks have shown an increase in crop yield and quality that has led to higher revenues due to the numerous benefits of wind protection. Yield increases for wheat are reported to be around 10% under an optimal structure and after the trees in the windbreaks have reached their final height.

Considering my farm size of _____ (e.g., 18 hectares), I estimate a total wheat production of _____ (e.g., wheat yield 3 ton/ha * 18 ha = 54 tons). Following the wheat market's price of _____ (e.g., Uzbekistan's 2022 wheat price USD 205.38 per ton), the estimated annual revenue is about _____ (e.g., 54 tons * 205.38 USD/ton = USD 11,070). After _____ (visiting/learning about) (e.g., visiting a neighbor's farm who has implemented sprinkle irrigation), I am interested in trying the system in my farm. Considering the referential price provided _____ (e.g., USD 4,000 per hectare), I am interested in investing in this system in _____ (e.g., one hectare) of my farm.

In addition, for protecting _____ (e.g., 18 ha), I have decided (or an expert/consultant has suggested me) to plant _____ (e.g., 500 meters of linear windbreak perpendicular to the northern winds) with _____ (e.g., Karatal trees in row-spacings of 2m which will provide, once mature and with a height of 15m, approximately 60m of upwind and 300m of downwind protection against crop damaging considering Karakalpakstan wind velocities of 5m/s during March and April). The investment in trees to be planted is _____ (e.g., 500m of trees / 2m spacing = 250 trees * 0.18 USD/tree = 45 USD).

As a farmer situated in _____ (e.g., Kegeyli district) I have seen an increase in the occurrence of dust storms and reduction in water availability for irrigation which have affected my farm as well as my neighbors' farms. I have been a farmer for _____ (e.g., the last 15 years) and I am looking for options to improve my farm's production as well as to have a positive impact in my farm's surroundings.

2. The Business Idea

2.1. The Green Business Model

The green business model consists in the production of wheat with sprinkle irrigation system and protected with tree windbreaks for creating ecosystems services that will positively impact my farm's productivity and my farm's surroundings. For this, my responsibilities will be to source raw materials and produce agricultural products by leveraging labor and equipment, while taking care of and proper manage the sprinkle irrigation system and the trees planted as windbreaks.

As part of these responsibilities, an estimate of water consumption with and without sprinkle irrigation system, as well as carbon sequestration from mature trees will be calculated. The estimated reduction in water consumption and carbon sequestration will serve for communicating to my customers and relevant government institutions on the farm's contribution for adapting to and mitigating climate change.

Implementing sprinkle irrigation and planting trees for windbreaks will also bring advantages to my customers by improving the yield and quality of the products, while securing the supply and overall supporting food security efforts in the region.

Furthermore, I will also register my full-time and seasonal employees as staff on my farm as part of my sustainable business activities, contributing to environmental, social, and governance criteria. The official registration procedure for staff gives my employees access to social security services and will have a positive impact on the social structures and security system in my neighborhood. It is very important for me that my activities reflect environmental as well as social responsibility.

3. Personal qualification

3.1. Professional qualification

(EXAMPLE) After graduating from high-school I attended agricultural vocational studies for 2 years. While exercising my profession as a farmer during the past 15 years, I have attended technical agriculture seminars for improving the management of my farm as well as for keeping records of my business practices for improving decision making. The last seminar I attended was provided by DSIK where I learned about how to conduct my business, develop a business plan and how to talk with banks.

3.2. Entrepreneurial qualification

(EXAMPLE) My continuous seek for doing things better respond to my desire to improve the productivity of my farm to support my family, as well as to create a favorable environment for me and my neighbors which can allow us to continue our production practices in the long-term.

While helping my parents with the production of wheat I got good insights of everyday farm business life from an early age. Following my technical learning and my work for the last 15 years, I have looked for solutions that can help me improve my farm's production while not having a negative impact in the environment and while improving the welfare of my employees.

As main manager of the farm, I have been responsible year after year for the production of wheat, the purchase of inputs like, for example, seeds and fertilizers, as well as for preparing the land and securing a proper production process. This experience has allowed me to understand the proper management of the farm and the need for seeking solutions that can further improve the productivity of it.

3.3. Motivation to implement a green business model.

(EXAMPLE) I have recently attended a training session in which I acquired knowledge of the additional benefits from water saving technologies and planting trees around farms for wind protection and for improving the environment in my region. In addition, I was able to understand my farm's vulnerability to climate change and the need to take action now in order to improve the adaptive capacity of my farm to keep producing crops in the long-term. It also made me aware of the responsibility that I bear as a local employer for nature as well as for my staff and their families.

It is important to me to be able to secure a long-term production of my farm and achieve profitable returns. Therefore, I have been looking for actions that I can take on my farm in order to improve the yield of my inputs and secure the farm's long-term productivity. While seeking for solutions for my farm, I got to understand that some solutions will not only impact positively to my farm, but they will also have a positive impact on my neighbor's farm as well as on our community. Therefore, I am eager to implement actions that can help me and the people around me to have a better future.

4. Market

4.1. Market volume

(EXAMPLE) Uzbekistan is currently the largest consumer of wheat in Central Asia, with an estimated domestic consumption of around 8.5 million tons for 2023 according to an online source called APK INFORM. Yet, domestic production in Uzbekistan is expected to cover only 78% of local consumption.

According to the article 'Improving the Economic Efficiency of Agricultural Production by its Diversification in the Republic of Karakalpakstan' available in Cyberleninka, in Karakalpakstan, around 85,767 ha of land have been allocated for wheat production. Actual yields in the region appear to vary widely, ranging between 0.5 to 3 tons per ha depending on access to water at critical growth stages, management, soil fertility classification, and other factors. Considering a high production yield, the total wheat production in Karakalpakstan can be estimated at 257,300 tons. On the other hand, Uzbekistan's wheat consumption per capita stands at 245 kg per year. Considering Karakalpakstan's population of approximately 2 million people, a rough estimate for the region's wheat consumption would indicate the need for approximately 489,900 tons in 2023.

Considering these numbers, local production will cover only 53% of the region's estimated consumption, which triggers the need for importing wheat to cover the annual needs.

4.2. Market development/trend

(EXAMPLE) Uzbekistan is a net importer of wheat. In fact, the 2011 to 2020 decade presented a wheat trade deficit increase for Uzbekistan from USD 64 million to USD 588 million according to OEC.world. Globally, geopolitical and climate events have affected wheat production and prices, exposing Uzbekistan's vulnerability to drastic price fluctuations. For instance, the conflict in Ukraine led to an increase of bread prices in Uzbekistan by as much as 75%.

In terms of prices, online news mentioned that Uzbekistan's wholesale wheat prices are expected to range between USD 190 and USD 210 per ton in 2023, lower than international prices. In terms of demand, the continuous growth in consumption and government efforts to bolster food security will put pressure to increase local production of wheat.

4.3. Risks in the market

(EXAMPLE) In order to improve productivity, my neighbors are resorting to short-term measures to increase production like an excessive use of synthetic fertilizers. Yet, I have opted to apply different measures following the Good Agriculture Practice Manual for Uzbekistan, implementing water efficient irrigation technologies, as well as planting trees that will take longer to have a positive impact in my farm. Therefore, in the short-term, I may face a competitive disadvantage against my neighbors in terms of economic performance.

Another risk is the possible disinterest of my buyers and government institutions in the positive impact of my practices in the long-term, especially in terms of water conservation and carbon sequestration. However, considering the Global and Uzbekistan's agenda for the development of the agriculture sector and for adapting to and mitigating climate change, taking actions now as well as reporting on the benefits of these actions will take high relevance in the near future. Additionally, aligning my business activities with environmental, social, and governance criteria can attract free funding, technical assistance, and other benefits through international donor organizations.

SECTION 4 NOTE – Potential Source of Information:

For Uzbekistan

- Agriculture Statistics – https://stat.uz/en/official-statistics/agriculture
- Product prices and news - https://agromart.uz/en (APP - Agromart)

For Karakalpakstan

- Agriculture Statistics – https://stat.uz/en/official-statistics/agriculture
- Regional Statistics - https://karakalpakstan.uz/en/page/show/1
- Product prices, knowledge materials, and news - https://greenaral.uz/en (APP - Jasilawil)

5. Customers

5.1. Operating radius

(EXAMPLE) My farm is located in Kegeyli District, northwest of Kazanketken township, in the Republic of Karakalpakstan. The total farm size is 18 ha, it has access to a primary canal for irrigation purposes, and it is exposed to winds of 5 m/s.

5.2. Target group

(EXAMPLE) In Karakalpakstan, wheat production can be contracted with either *Don Maxsulotlari*, the state join stock company, or with *AgroClusters*, which work mostly with small farmers. The latter provides loans and inputs on consignment early in the season.

5.3. Customer needs and customer benefits

(EXAMPLE) The Government is the largest buyer of wheat in the region. Livestock farms also buy but in less quantity through village aggregators or from the bazar as fodder. In terms of market needs, in order to meet consumer requirements there is a high demand for quality and safely produced products. Unfortunately, the current local production is of low quality and in limited quantity. There are no clear safety and quality standards along the supply chain which results in lower prices for locally produced products.

6. Competitive Analysis

6.1. Preliminary remarks

(EXAMPLE) In the following section I have identified local competitors producing wheat within a radius of 10 km. In addition to the 3 farms described below, there are multiple wheat production farms in the region. Most of them follow the same type of activities with little differentiation among them.

6.2. Competitor 1

(EXAMPLE) Wheat farming entity with a farm size of 10 ha and access to primary canal with limited water for irrigation.

6.3. Competitor 2

(EXAMPLE) Wheat farming entity with a farm size of 5 ha and access to secondary canal with limited water for irrigation.

6.4. Competitor 3

(EXAMPLE) Wheat farming entity with a farm size of 10 ha, access to primary canal for irrigation purposes.

7. Sales and Communication

(EXAMPLE) There is little differentiation between wheat production farms in the region. Therefore, I find the implementation of sprinkle irrigation and tree for windbreaks, as well as the reporting of water conservation and carbon sequestration as a good differentiation strategy to showcase my commitment to improve my farm practices with a positive impact to my surroundings. Currently, there are online platforms in Karakalpakstan, like for example Jasilawil, where I can showcase my farm's experience in order to motivate other farmers to take action, as well as to capture the attention of programs that are supporting farmers to further improve the productivity of their farms. By showcasing my commitment to contribute to a positive change, it may provide me with the opportunity to access to additional green technologies and financing to keep improving my farm practices.

8. Procedures and Organization

8.1. Core processes

(EXAMPLE) As the responsible and representative for my farm, I would like to set up a mutual agreed contract with *AgroClusters*. My differentiation with other farmers will be the annual reporting on water conservation, trees' status, and carbon sequestration as a mechanism to support the government efforts against climate change and environmental improvement.

I will be responsible to acquire the needed production inputs, as well as negotiating and registering contracts for additional labor required. I will also be in charge of managing the soil preparation, planting, caring, controlling for pest and diseases, and harvesting, following the Good Agriculture Practice Manual for Uzbekistan.

8.2. Supporting processes

(EXAMPLE) I am supported by my partner in accounting. My partner has very good knowledge in this area following the education received and previous work experience. For more complex questions or for the annual accounts and tax payment, I will consult with a tax consultant.

In addition, I will make use of the pool of consultants available on the platform Jasilawil (e.g., Agromart for Uzbekistan) for any additional technical or farm management question that I need to clarify.

SUB-SECTION 8.2. NOTE – Potential Platform for Accessing Support:

For Uzbekistan

- Consultation Services - https://agromart.uz/en (APP - Agromart)

- Chamber of Commerce and Industry of Uzbekistan - https://chamber.uz/en/index

For Karakalpakstan

- Consultation Services - https://greenaral.uz/en (APP - Jasilawil)
- Chamber of Commerce and Industry of Uzbekistan - https://chamber.uz/en/index

8.3. Staff planning

(EXAMPLE) In addition to my own and my partners' labor force, my farm regularly employs 1 full time staff and 8 seasonal staff. The staff employed is and will continue to be formally registered keeping their employment record book open. This allows and will allow to keep contributing as employer to the Social Tax and secure their social benefits.

8.4. Infrastructure and Equipment

(EXAMPLE) No major infrastructure is needed for operating the farm. In terms of equipment, I have hired a consultant to support me designing the implementation of sprinkle irrigation as well as where and how to plant the trees. In addition, I will lease a truck from local service providers when necessary.

SUB-SECTION 8.4. NOTE – Potential Platform for Accessing Technology Support:

For Uzbekistan

- Consultation Services - https://agromart.uz/en (APP - Agromart)
- Innovation and Tech Support - http://akis.agro.uz/uz
- Water Management Equipment and Consultancy – APP - TOMЧI

For Karakalpakstan

- Consultation Services - https://greenaral.uz/en (APP - Jasilawil)
- Water Management Equipment and Consultancy – APP - TOMЧI

9. Explanation of target figures.

(EXAMPLE) The revenue planning is based on 200 field workdays, considering a farm size of 18 hectares, and an annual wheat production of 54 tons, all calculated for one year. The estimated annual revenue of USD 11,070 considers the wheat market price in Uzbekistan for 2022 (205.38 USD/ton). In addition to the annual revenue from grain, I have also estimated the revenue from wheat straw bales, which is a secondary commodity. Considering an estimated yield of 400 bales per hectare and a price of USD 0.89 per bale, an additional annual revenue of USD 6,408 (400 bales/ha * 18 ha * 0.89 USD/bale) has been considered. On the other hand, the operational expenses consider those related to planting, cultivation costs, labor costs, harvest costs, and profit and other taxes. Based on previous annual performance, the total operational expenses are estimated at approximately 90% of the total income.

In terms of additional investment for the farm, the sprinkle irrigation system that I am interested in installing in one hectare of my farm has a value of USD 4,000 including the installation costs. I will acquire a credit of 4 years for covering the USD 4,000 needed to acquire and install the equipment. In addition, an expert/consultant has suggested me to plant 500 meters of linear windbreak perpendicular to the northern winds with Karatal trees in row-spacings of 2m which will provide, once mature and with a height of 15m, approximately 60m of upwind and 300m of downwind protection against crop damaging considering Karakalpakstan wind velocities of 5m/s during March and April. The investment in trees to be planted is (500m of trees / 2m spacing = 250 trees * 0.18 USD/tree) 45 USD. The expert has suggested me to plant Karatal considering its potential future source of income by selling Karatal cuttings or lumber if proper tree management practices are applied. As potential source of income, a conservative price of USD 0.15 per Karatal cutting has been considered after reaching the maturity of the trees (after 4 years), according to the opinion of the expert/consultant (10 lumber per tree per year).

10. Revenue and Profitability forecast

(EXAMPLE)

Years	1	2	3	4	5	6
A) Income (1+2)	17,478	17,478	17,478	17,478	17,853	17,853
1) Wheat Income (a + b)	17,478	17,478	17,478	17,478	17,478	17,478
a) Wheat grain	11,070	11,070	11,070	11,070	11,070	11,070
Yield (farm yield, tons)	54	54	54	54	54	54
Price per unit (USD/ton)	205	205	205	205	205	205
b) Wheat straw bales	6408	6408	6408	6408	6408	6408
Yield (farm yield, bales)	7,200	7,200	7,200	7,200	7,200	7,200
Price per unit (USD/bale)	0.89	0.89	0.89	0.89	0.89	0.89
2) Tree Income (c x d)	0	0	0	0	375	375
c) Product (cutting, lumber, fruit)					2,500	2,500
d) Price per unit (USD/ton)					0.15	0.15
B) Operational Expenses (3+4+5+6+7)	12,893	12,893	12,893	12,893	12,931	12,931
3) Crop Operational Expenses (e+f+g)	8,966	8,966	8,966	8,966	8,966	8,966
e) Planting						
Ploughing	150	150	150	150	150	150
Seedbed preparation	130	130	130	130	130	130
Sowing	25	25	25	25	25	25
Fertilization	63	63	63	63	63	63
Grain transportation to farm	38	38	38	38	38	38
f) Inputs						
Seed	1,660	1,660	1,660	1,660	1,660	1,660
Fertilizers	1,755	1,755	1,755	1,755	1,755	1,755
Pesticides	638	638	638	638	638	638
Water (irrigation)	713	713	713	713	713	713
Equipment maintenance	350	350	350	350	350	350
Diesel	400	400	400	400	400	400
g) Harvest						
Combine harvester	1,100	1,100	1,100	1,100	1,100	1,100
Hay baler (USD 0.27/bale)	1,944	1,944	1,944	1,944	1,944	1,944
4) Tree Operational Expenses (h+i)	166	166	166	166	204	204
h) Inputs & Caring						
Weed control	33	33	33	33	33	33
Tree pruning	35	35	35	35	35	35
Pest management	40	40	40	40	40	40
Fertilization	58	58	58	58	58	58
i) Harvest						
Collecting (lumber)					38	38
5) Labor (j+k)	2,182	2,182	2,182	2,182	2,182	2,182
j) Personnel	2,160	2,160	2,160	2,160	2,160	2,160
k) Taxes on salaries* (12%)***	21.6	21.6	21.6	21.6	21.6	21.6

6) Depreciation (l)	667	667	667	667	667	667
l) Equipment	667	667	667	667	667	667
7) Input Taxes** (m+n+o)	912	912	912	912	912	912
m) Turnover (4% or 12%)***	350	350	350	350	357	357
n) Water (4 USD/m^3)***	638	638	638	638	638	638
o) Land (4 USD/ha)***	36	36	36	36	36	36
C) Earnings Before Interest and Taxes (A – B)	4,585	4,585	4,585	4,585	4,922	4,922
D) Interest and Loan Repayment (8+9)	1,680	1,510	1,340	1,170	0	0
8) Loan Repayment	1,000	1,000	1,000	1,000		
9) Interests (17%)	680	510	340	170		
E) Taxes (10)	218	231	243	256	369	369
10) Income Tax (15%) [(C-D)*Tax%]	218	231	243	256	369	369
F) Net Income (C - D - E)	2,687	2,844	3,002	3,159	4,553	4,553

*_Social Tax_ – 12%

** _Turnover Tax_ – 4% from total sales when entities annual turnover does not exceed USD 100,000. 12% when annual turnover exceeds USD 100,000. _Water Tax_ for agriculture lands – estimated at USD 4 per m^3. _Land Tax_ is based on soil fertility and the type of land (irrigated or dry-land) – estimated at USD 4 per hectare.

*** According to Presidential Decree No. 213 (August 31, 2022) '*On additional measures to improve the welfare of the population of the Republic of Karakalpakstan through the accelerated development of entrepreneurship, innovative technologies and infrastructures*', enterprises in Karakalpakstan, including farming entities, will pay 50% of all '*Input & Turnover Taxes*', as well as of '*Income Tax*', and 1% of '*Social Taxes*' from January 1st, 2023, until January 1st, 2028.

11. Capital Requirements and Financing

(EXAMPLE)

	Total Cost	Financing costs per year
G) Long-term investments	4,295	
11) Property		
12) Structure		
p) Greenhouse/hotbed		
13) Machinery		
q) Trellis system (inc. installation)		
r) Tractor		
s) Tractor equipment		
t) Irrigation system (inc. installation)	4,000	17% Interest (4 years)
14) Tree planting		
u) Land preparation	175	
v) Analyses (soil, layout)	75	
w) Trees	45	
H) Medium- and Short-Term Investments		
15) Equipment		
I) Upfront Costs		
16) Registration		
17) Legalization		
18) Education and Training		
J) Total Capital Required	4,295	
K) Expenditures per year		4,295

12. Environmental Benefits

(EXAMPLE)

Years	1	2	3	4	5	6
L) Carbon Sequestration (tCO2)	0	0	0	0	2.5	2.5
19) Number of trees	250	250	250	250	250	250
20) Carbon sequestration per tree*	0	0	0	0	0.01	0.01

*Carbon sequestration per year estimated once the tree reaches maturity after the 4th year and before it has reached 30 years.

M) Water Conservation (m^3/day/ha) (21 - 22)	25.53
21) Under surface irrigation [(x/y) * (1 + z) * ω]	127.65
x) Daily crop evapotranspiration~	6.9
y) Irrigation system application efficiency~	60%
z) Leaching requirement~	11%
ω) Multiplier for conversion of mm/day to m^3/ha	10
22) Under sprinkle irrigation [(x/y) * (1 + z) * ω]	102.12
x) Daily crop evapotranspiration~	6.9
y) Irrigation system application efficiency~	75%
z) Leaching requirement~	11%
ω) Multiplier for conversion of mm/day to m^3/ha	10
N) Total water conservation (M * # of ha under sprinkle irrigation - m^3/day)	25.53

~Referential information is provided in Annex 1.

13. Profit to cover living expenses.

	Per month	Per year
O) Living expenses		
23) Food		
24) Clothing		
25) Health		
26) Education		
27) Others		
P) House expenses		
Q) Social Security		
28) Insurance		
29) Pension		
R) Interests and Taxes		
30) Loan repayment and interests		
31) Taxes		
S) Total household expenses (O+P+Q+R)		

ANNEX 1: Water Conservation Referential Information

1. Crop's maximum daily evapotranspiration (ET_c)

Evapotranspiration is the loss of water from the soil both by evaporation and by transpiration from the plants growing thereon. Evapotranspiration is not the same for different plants and it also varies with the season. The maximum evapotranspiration during the season is used for designing irrigation systems. The maximum crop evapotranspiration rates have been calculated based on research conducted in the Amu Darya River Basin and shown in the Table 1 below for reference.

Table 1	
Crop	ETc (mm/day)
Cotton	8.5
Wheat	6.9
Rice	7.3
Alfalfa	6.7
Maize	8.5
Vegetables	6.3
Melon	7.4
Fruits	6.0
Sorghum	7.1
Potato	8.1

2. Irrigation System Application Efficiency

Irrigation application efficiency expresses how much of the irrigated water is actually available to the plant. The lower the efficiency, expressed as a percentage, the more water must be irrigated to satisfy the crop's needs. Table 2 summarizes the application efficiencies of different irrigation methods for reference.

Table 2	
Irrigation methods	Field Application Efficiency
Surface irrigation (border, furrow, basin)	60%
Sprinkler irrigation	75%
Drip irrigation	90%

3. Leaching Requirement

All irrigation water contains salt. Plant roots extract nutrients from the soil solution leaving most salts behind. If the salts are not leached out of the plant's rootzone, the accumulation of salts will create a lower osmotic pressure in the soil thereby hindering the roots' ability to function normally. The plant expends extra energy to extract nutrients leading to stress, physiological damage, and lower yields. Additionally, sodium and chloride are toxic to many plants. The Leaching Requirement, or Leaching Fraction, refers to the amount of additional water required to leach salts out of the

rootzone of your crop. The higher the salt content of your irrigation water, the higher the leaching requirement.

Table 3 shows the estimated Leaching Requirement as a percentage where the **irrigation water salinity (ECw)** and the **maximum soil salinity threshold for crops (ECe)** intersect.

Table 3 Irrigation Water Salinity (Electrical Conductivity) (ECw)

Maximum Soil Salinity Threshold (ECe) dS/m	0.2	0.5	0.7	1.0	1.3	1.5	2.0	2.5	3.0	4.0	5.0	6.0	7.0
0.5	9	25	39	67	108	-	-	-	-	-	-	-	-
1.0	4	11	16	25	35	43	67	100	-	-	-	-	-
1.5	3	7	10	15	21	25	36	50	67	114	-	-	-
2.0	2	5	8	11	15	18	25	33	43	67	100	-	-
2.5	2	4	6	9	12	14	19	25	32	47	67	92	-
3.0	1	3	5	7	9	11	15	20	25	36	50	67	88
3.5	1	3	4	6	8	9	13	17	21	30	40	52	67
4.0	1	3	4	5	7	8	11	14	18	25	33	43	54
4.5	1	2	3	5	6	7	10	13	15	22	29	36	45
5.0	1	2	3	4	5	6	9	11	14	19	25	32	39
5.5	1	2	3	4	5	6	8	10	12	17	22	28	34
6.0	1	2	2	3	5	5	7	9	11	15	20	25	30
6.5	1	2	2	3	4	5	7	8	10	14	18	23	27
7.0	1	1	2	3	4	4	6	8	9	13	17	21	25

These two pieces of information will allow you to calculate your leaching requirement which will directly affect the volume of water your irrigation system needs to deliver.

3.1.Irrigation Water Salinity (ECw)

First, you must know the salinity of the water you are using for irrigation. Both water and soil salinity are usually measured by its electrical conductivity, either dS/m or uS/cm. Water salinity may be measured easily by a handheld meter.

3.2.Maximum Soil Salinity Threshold (ECe)

The table below shows the maximum documented salinity thresholds for plants at which there will be no expected reductions in yields. The table has been compiled from several sources and serves for referential purposes.

Plant (Common Name)	Maximum Soil Salinity Threshold at Which Growth and Yield Reductions Begin (ECe dS/m)
Small Vegetables	
Broccoli	2.8
Brussel sprouts	1.8
Cabbage	1.8
Carrots	1.0
Cauliflower	1.8
Celery	2.5
Lettuce	1.7
Onions	1.2
Spinach	3.2
Radishes	2.0
Vegetables (Solanum Family)	
Egg Plant	1.5
Peppers	1.7
Tomato	2.5
Vegetables (Cucumber Family)	
Cucumber	2.5
Cantaloupe melon	2.2
Musk melon	1.0
Pumpkin, winter squash	3.9
Squash, Zucchini	4.7
Squash (Scallop)	3.2
Watermelon	2.0
Roots and Tubers	
Beets, red	4.0
Garlic	3.9
Parsnip	0.8
Potato	1.7
Sweet potato	1.5
Turnip	0.9
Sugar beet	7.0
Legumes	
Beans	1.0
Broadbean (faba bean)	1.6
Cowpea	4.9
Peanut	3.2
Peas	1.5
Soybeans	5.0
Chickpeas	3.0
Perennial Vegetables	
Aritchokes	6.1
Asparagus	4.1
Mint	
Strawberries	1.5
Fibre Crops	
Cotton	7.7
Flax	1.7

Plant (Common Name)	Maximum Soil Salinity Threshold at Which Growth and Yield Reductions Begin (ECe dS/m)
Oil Crops	
Safflower	5.3
Sunflower	2.3
Caster bean	7.1
Cereals	
Barley	8.0
Oats	5.2
Corn	1.7
Sweet corn	1.7
Millet	6.0
Sorghum	6.8
Rice	3.0
Wheat	6.0
Wheat (semidwarf)	8.6
Wheat (durum)	5.9
Forage Crops	
Alfalfa	2.0
Barley	6.0
Bermuda	6.9
Clover	1.5
Cowpea (forage)	2.5
Fescue	3.9
Foxtail	1.5
Hardinggrass	4.6
Lovegrass	2.0
Maize (forage)	1.8
Wheatgrass, tall and fairway crested	7.5
Wheatgrass, standard crested	3.5
Grapes and berries	
Raspberries	1.0
Blackberry	1.5
Boysenberry	1.5
Grapes	1.5
Fruit Trees	
Almonds	1.5
Apples	1.7
Peaches	1.7
Nectarines	1.6
Cherries	0.9
Pear	1.7
Apricot	1.6
Plum, prune	1.5
Pomegranate	2.7
Walnut	1.7
Persimmon	2.0
Chinese Date	4.0
Figs	6.0
Deciduous Trees	
Poplars	4.0
Willow	4.0