Using Industrial Barley Washed-out Wastewater for Irrigation

Amare Tadesse

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Ethiopian Institute of Agricultural Research
Using Industrial Barley Washed-out Wastewater for Irrigation

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Website: http://www.eiar.gov.et
Tel: +251-11-6462633
Fax: +251-11-6461294
P.O.Box: 2003
Addis Ababa, Ethiopia


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Introduction

In most parts of Ethiopia, the main source of water for crop production is rainfall. Currently, however, it has become erratic, and unevenly distributed. Inadequate soil and water management also are tremendously interrupting the effectiveness and sufficiency of rainfall, even in high rainfall receiving areas. There is also scarcity of water during dry cropping seasons. As a result, it becomes an obligation to establish water conservation and irrigation systems to have it in Ethiopia. To achieve this, farmer participation and coordination of the efforts of different institutions is highly considered.

According to the United Nations Population Fund and Central Statistical Agency of Ethiopia (CSA, 2007), the world and Ethiopian population surpassed 7 billion and 73 million, respectively. The continuous increase of the demographic situation of Ethiopia has made it imperative to increase agricultural productivity and production to feed the visibly noted increasing population. When we were few in population and drought was not as frequent as it is now, rain fed agriculture could and did feed our population (Mulugeta and Karl 2002).

In a nutshell, it is crystal clear that rain fed cultivation alone will no longer support us, even in good cropping years to be able to attain food self-sufficiency sustainably. Therefore,
using our water resources in the form of irrigation is crucial to an extra rain fed cultivation, ensure sustainable agriculture, and coop within the periods of inadequate rainfall.

Land application of wastewater, sludge, and extract is a widely practiced in different countries. For centuries, farmers in China used human and animal excrements as fertilizers. Wastewater and sewage sludge, as manure, have also been used by the northern European and Mediterranean civilizations (Soulie and Tréméa, 1991). In many European and North American cities, wastewater was disposed of in agricultural fields before the introduction of wastewater treatment technologies to prevent pollution of water bodies. In Paris, for instance, the use of partially treated wastewater was common until the second part of the 1990s (Asano et al., 2007).

Agricultural use of untreated wastewater has been associated with land application and crop production for centuries (Keraita et al., 2008). However, over the years, it has become less popular in developed countries with the improvement of treatment technologies and increased awareness of the environmental and health issues associated with the practice; by contrast, in developing countries, due to a variety of factors described later, farmers use it extensively, even drawing advantages to improve their livelihoods. The oldest references to the use of extract come from some Asian countries, where it was used to increase fish production through aquaculture (WHO, 2006). Sludge management has only recently become an issue, even for developed countries, because the densely populated areas are producing such large amounts of sludge.
and extract that natural assimilation into the environment is not possible, while space for stockpiling is limited (UNHSP, 2008).

Moreover, management is complex and there is a lack of social support: people prefer to ignore what happens to extract after it is disposed of into latrines and they are uncomfortable if it is brought to their attention, be it in developed or developing countries (Snyman, 2008). This report attempts to give an overview of the use of wastewater, extract, and fecal sludge in agriculture; to characterize their use, the benefits derived, and the costs involved, particularly regarding health consequences; and to provide perceptions around such uses and perspectives for the future. It is to be noted that whilst mention will be made of reclaimed or recycled water, where relevant, the main thrust will be on non-treated wastewater.
Descriptions of the Project

The study relates to the method of wastewater treatment for irrigation occupations, and particularly to a wastewater treatment system and method that removes biodegradable pungent smells, organic contaminants, over saturated nutrients, pathogens and the like from wastewater generated in residential homes, commercial businesses, industrial facilities, municipal facilities, agricultural facilities, and the like.

In order to protect the environment and promote public health, communities require wastewater treatment. The discharge of untreated wastewater is not suitable, since it gives rise to numerous environmental concerns, such as the pollution of surface and groundwater resources. Untreated wastewater contains organic matter and nutrients that, if left untreated and not removed from the waste stream, can result in environmental pollution. Thus, when untreated wastewater is released into either aboveground bodies of water or subsurface drain fields, the level of dissolved oxygen in the receiving waters begins to deplete, which endangers the water bodies themselves, along with the resident plant and aquatic life. Furthermore, in our country, where potable water is scarce, it is often desirable to recover as much reclaimable water as possible from wastewater, rather than disposing of both the wastewater and the contaminants. To treat wastewater, communities in highly populated areas commonly collect wastewater and transport it through a series of underground
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pipes to a large centralized wastewater-mixing chamber. However, there are several problems associated with large, centralized treatment chamber. Centralized wastewater treatment chamber is invented and rated for processing a specific flow rate of treated wastewater per hour, typically expressed as the rated capacity of the mixing chamber, and all treatment pump house have a paramount flow rate capacity.

As a result, if a centralized treatment chamber receives more wastewater on a particular hour than what the mixing chamber was invented to handle, problems are encountered. For example, when a mixing chamber receives larger-than-normal amounts of untreated raw wastewater, treatment performance decreases and partially treated or untreated wastewater is released into a body of water, such as a river, in order not to exceed the amount of wastewater the method of wastewater treatment for irrigation purposes was invented to handle. As noted above, discharge of this untreated wastewater into the river will endanger and harms resident populations and aquatic life in the river.

Untreated wastewater also contains a number of disease pathogens that are extremely harmful to humans. For instance, untreated wastewater is one of the most important causes of dysentery, which can be life destructive. Thus, if a significant amount of untreated wastewater is discharged into a river, that the river will become unavailable for human consumption. On the other hand, if the wastewater treatment is larger than amount of untreated wastewater, instead of diverting a portion into the storage ponds, the arrival of untreated wastewater
would wash away the bacteria populations or biomass used by the mixing chamber to treat untreated wastewater, which would disorder the wastewater treating process in the mixing chamber.
Materials and Methods

The project Area
The project area is a humid tropical area. This area has generally rising and falling land feature, though the slope of the project area found in between of 1 and 7% and particularly the project area of topography is flatter landscape. Construction materials were assessed and located economical distances from the project area. Based on that the geomorphologic setting and engineering requirement, the ponds site were selected to command the target area. The ponds site is formed of 0.40 m thick dark plastic clay, under lain by about 1.20 m thick deep weathered tuff.

Ignimbrite rock for required building material work is available at Gonde River, about 4 km from Kulumsa to Abura, near the bridge constructed across the same River. The rock is ample in amount and the site is accessible on all-weather roads running to Abura.

Sand of good quality was secured from Bofa, which is located at 80 km from the project site, i.e., Kulumsa Agricultural Research Center (KARC). This site is feasible for the intended purpose, however to efficient utilization of the water can be stored and it is essential to compact the soil at the ponds site to curtail the impact of seepage water loss. That is why this project has been inaugurated in the Kulumsa Agricultural Research Center in front of the Asella Malt Factory (AMF), at
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the left side of the main asphalt road from Addis Ababa to Asella Town.

Assela Malt Factory (AMF) is located in front of KARC across the road from Assela to Addis Ababa. The factory has about 250 employees, facilitated by services such as treated drinking water, canteen, a laboratory, a clinic, lavatories, and showers. Wastewater in the factory does not have well-established treatment system other than septic tank and percolation ditch, which are meant for treating mainly domestic swage.

According to the common Ethiopian agro-climate classifications, KARC has woinadega (wet-warm) climatic zone. It has a bimodal rainfall type; the first and smaller rains (belg) peaking in April, and the second in mid-September. The climate is conducive for crop and livestock production. The major soil orders in Andosols and Vertisols are covering 35 and 45 percent of the total area, respectively. KARC has a mixed crop-livestock farming system. Farmers produce both crops and livestock while the latter is no good with increasing demand farmland as a result increased population growth. Crops grown in this area are cereals, pulses, and some oil seeds. The dominant crops grown are cereals, particularly wheat followed by barley. However, other crops such as tef, sorghum, maize, beans, peas, lentils, and oil seeds have also produced in smaller amounts.

Sources of data
The data used for this pilot study have gathered from primary and secondary sources. The primary data were gathered
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through laboratory and field studies and unofficial in-depth interview including telephone communications and visual desiccation with the Soil and water researchers and with other most relevant experts at the AMF and researchers at the KARC. Informal discussion was made with the groups to get their broader view before and after structured interviews.

Features of barley washed-out extract
In AMF, malting involves germination of barley grain until the starchy food-store (endosperm), available for development of the germ of the grain has snuffed some degradation by enzymes. Malt is; therefore, cereal usually barley, which has germinated for a limited period of time, growth of the embryo being terminated by drying. Several biochemical and physical changes occur in germination that converts barley into malt.

However, some major phenomena, which take place in the steeping process, are the primary sources of wastewater in the factory. However, the barley is wash, aerated during steeping, and free from dust especially when the steep is aerated. Light corns and awns float to the surface and are collect by screening. As a result, the steeped liquors have a rich solution of microbial nutrients including amino acids, hexose and pentose sugars, phenolic and simple carboxylic acids and phosphates. These nutrients enter in to solutions from the husks of intact grains and from the inferior of damaged, split or half-grains.

The dissolved materials are metabolized by microorganisms from the malt husk, with the consumption of oxygen and the
production of acetic acid. What makes wastewater from Asella malt factory typical is that it is the only wash out of barley seeds pending for making malt. In this process, no additional chemical is added to the water and therefore the wastewater refers to the barley steeping water only can easily be utilized for irrigation purposes.
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Results and Discussion

Laboratory test analysis

Depending on the results of the laboratory analysis for the quality of the wastewater and filed experiments, the wastewater has been found to be safe to use it for irrigation.

Based on the result of environmental control growth chamber of the glass pot experiment for the quality of the malt barley scrub-down extract and filed observation has proved that barley scrub-down extract is appropriate with proper percentage of dilution to use it for irrigation tasks. Results of pot experiments on the performance of wheat, barley, field pea and faba bean watered with barley scrub-down extracts from Asella malt factory (Tables 1-4).

Table 1. The effect of barley scrub-down extracts on the performance of shoot length (cm)

<table>
<thead>
<tr>
<th>Treatment (%)</th>
<th>Wheat</th>
<th>Barley</th>
<th>Field pea</th>
<th>Faba bean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (0)</td>
<td>8.24</td>
<td>6.17</td>
<td>6.00</td>
<td>1.65</td>
</tr>
<tr>
<td>25</td>
<td>17.83</td>
<td>14.69</td>
<td>14.16</td>
<td>5.03</td>
</tr>
<tr>
<td>50</td>
<td>17.33</td>
<td>13.88</td>
<td>14.49</td>
<td>5.69</td>
</tr>
<tr>
<td>75</td>
<td>16.01</td>
<td>13.29</td>
<td>14.06</td>
<td>4.11</td>
</tr>
<tr>
<td>100</td>
<td>12.13</td>
<td>6.21</td>
<td>7.33</td>
<td>1.75</td>
</tr>
</tbody>
</table>
Table 2. Effect of barley scrub-down extracts on the performance of shoot biomass (g)

<table>
<thead>
<tr>
<th>Treatment (%)</th>
<th>Barley</th>
<th>Field pea</th>
<th>Faba bean</th>
<th>Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (0)</td>
<td>0.58</td>
<td>0.23</td>
<td>1.12</td>
<td>7.01</td>
</tr>
<tr>
<td>25</td>
<td>4.41</td>
<td>12.65</td>
<td>6.76</td>
<td>12.85</td>
</tr>
<tr>
<td>50</td>
<td>5.43</td>
<td>11.75</td>
<td>7.07</td>
<td>13.11</td>
</tr>
<tr>
<td>75</td>
<td>3.78</td>
<td>9.90</td>
<td>5.43</td>
<td>12.03</td>
</tr>
<tr>
<td>100</td>
<td>1.21</td>
<td>7.50</td>
<td>3.82</td>
<td>5.20</td>
</tr>
</tbody>
</table>

Table 3. Effect of barley scrub-down extracts on the performance of root length (cm)

<table>
<thead>
<tr>
<th>Treatment (%)</th>
<th>Faba bean</th>
<th>Wheat</th>
<th>Field pea</th>
<th>Barley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (0)</td>
<td>2.04</td>
<td>7.09</td>
<td>9.51</td>
<td>14.18</td>
</tr>
<tr>
<td>25</td>
<td>5.97</td>
<td>19.59</td>
<td>18.55</td>
<td>19.61</td>
</tr>
<tr>
<td>50</td>
<td>4.33</td>
<td>19.98</td>
<td>17.34</td>
<td>19.34</td>
</tr>
<tr>
<td>75</td>
<td>2.96</td>
<td>14.23</td>
<td>14.42</td>
<td>17.19</td>
</tr>
<tr>
<td>100</td>
<td>2.45</td>
<td>8.56</td>
<td>11.56</td>
<td>5.12</td>
</tr>
</tbody>
</table>

Table 4. Effect of barley scrub down extracts on the performance of root biomass (g)

<table>
<thead>
<tr>
<th>Treatment (%)</th>
<th>Wheat</th>
<th>Barley</th>
<th>Faba bean</th>
<th>Field pea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (0)</td>
<td>0.34</td>
<td>0.20</td>
<td>2.23</td>
<td>4.74</td>
</tr>
<tr>
<td>25</td>
<td>4.42</td>
<td>1.45</td>
<td>10.83</td>
<td>11.53</td>
</tr>
<tr>
<td>50</td>
<td>4.65</td>
<td>1.37</td>
<td>9.71</td>
<td>11.68</td>
</tr>
<tr>
<td>75</td>
<td>3.11</td>
<td>0.65</td>
<td>7.45</td>
<td>9.04</td>
</tr>
<tr>
<td>100</td>
<td>1.03</td>
<td>0.4</td>
<td>5.94</td>
<td>4.26</td>
</tr>
</tbody>
</table>
Using barley washed-out water for irrigation

Based on the research findings, instead of discarding the wastewater as a waste, the research center itself and the downstream dwellers have begun using it for irrigation purposes. It is due to the research findings that the KARC and the downstream dwellers have begun producing at least twice a year and increasing their production per unit area per year.

On the basis of the wastewater diversion to the Kulumsa Research Center for irrigation functions, the eroded gullies being formed alongside of the main asphalt has been rehabilitated. Apart from this there is a 100 m of an open concrete ditch with four silt trap basin structures, so as to minimize the gradually accumulated sediments of the ponds. Those sediments, which steadily gathered from manhole and open ditch are used as natural compost or predominantly it can be utilized as an organic fertilizer. Thus, there are no any possibilities of industrial resources depletion.

Based on the results of quality tests conducted at the National Soil Testing Center, the wastewater (barley washed-out extract) is environmentally friendly for agricultural production purposes. Hence, shortening of the technology generation process and significant contribution towards the supply of preliminary materials for technology development are possible.

In accordance with the above-mentioned findings of a proper utilization of the wastewater, there is a need to mix the freshwater with the barley washed-out wastewater in order to get a suitable dilution at 25%, 50%, and 75% depending on
size of the field crops and vegetables all with by using the newly invented mixing chamber.

Wastewater can be considered as both as a resource and a problem. The production and reuse of wastewater has grown rapidly because of water scarcity, increasing population, and industrial and urban extension. The main characteristics used for wastewater characterization are organic matter, measured as biochemical oxygen demand (BOD). Suspended solids, nutrients (N, P), fecal coliforms bacteria, and toxic substances.

Industrial wastewaters are usually biologically degradable. Some contain high BOD (1000-20,000 bod/m³). However, the quantity and quality of wastewaters vary widely from industry to industry. High BOD concentration is not accepted for discharge into watercourses.

It is not recommended to discharge wastewater in to river or some other natural watercourses. Generally, there are two options of disposing industrial wastes. The first is to discharge the waste into a sewer system—where applicable—while the other method is to industrial waste alone. If industrial wastes consist of strengths of characteristics that are significantly different from sanitary wastewater, pretreatment should be considered at the industrial site.

Since the extract coming out of the Asella Malt Factory has been diverted to Kulumsa Agricultural Research Center, it will no more causing health problems and predicament to the upstream dwellers as to the previous times. The wastewater
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was creating soil erosion in the form of gully structure while passing through its previous course. The gully was at its active stage and increasing in both depth and width.

**Provision of irrigation water**
The extract from Asella Malt Factory is providing the KARC and all the downstream inhabitants of Wonji-Gora peasant association farmers and neighboring dwellers with a reliable resource of an additional water sources for drinking of their livestock, for irrigation and other ecosystem services.

**Decreasing chemical fertilizer and fostering organic agriculture**
The Studies revealed that barley washed-out extract holds important nutrients, which can serve as liquid plant nutrition. Applications of barley washed-out extract in the form of irrigation; therefore, conserves nutrients, thereby reducing the need for chemical fertilizers. Hence, making use of the potential of barley washed-out extract can minimize the consumption of chemical fertilizers and their consequent negative environmental impacts.

Apart from the benefits of the nutrients contained in the extract, the sledges that will be harvested from each silt trap can be used for composting; hence, fosters organic farming. The sediments, which steadily accumulate in manholes and settling basins are collected and used as organic fertilizer in the form of compost. Thus, there are no possibilities of resource depletions.
Contribution for microclimatic improvement
The newly constructed ponds with their capacity of 70,000 m$^3$ water will have a considerable positive impact with respect to improving the surrounding microclimatic condition. The aggregate effects of such activities can contribute significantly for counteracting the current treat of climate change.

Providing irrigation possibilities
Prior to diverting barley washed-out extract from AMF, the downstream farmers' did not have any sources of irrigation water to during dry cropping season. Hence, provision of the community with irrigation water can be taken as one of the positive social benefits from the execution of this irrigation development scheme.

Removing the social discomfort
The surrounding community was suffering from the bad smell generated while the wastewater passed along the main asphalt road of Addis Ababa to Asella. It was a long lasting social problem. After the wastewater was diverted to KARC, that social problem was practically solved. The grievance of the surrounding community in the form of some rational applications and sensible irritations made by them as well as other community associates.

Decreasing variety release time
Since one of the mandates of KARC is generation of new technologies, especially improved crop varieties, the utilization of irrigation water elongates period of research tasks and
Using barley washed-out water for irrigation hastens technology release-time. Hence, farmers’ will be provided with new technologies with in short period of time.

Creating scenic values
It will be a real amusement and indeed recreation to see the two ponds filled with water in their entire volume and their consequent green scene of the surrounding area.

Increasing production and diversity crops
Barley washed-out extract holds nutrients for crop production so that it increases crop yields and returns from farming (Hussain et al., 2001). A “non-motor built-in” pond amenities, along with taking the advantages of a “non-yield depilation ponds” is used to irrigate all types of field crops and vegetables during the dry cropping seasons. Crop production at least twice a year will be possible. Apart from this, barley washed-out could create possibilities for diversified cropping system such as double cropping.

Increasing income
Using Barley washed-out extract / wastewater for agriculture can create an occasion of extra work to have; thereby, create an employment opportunities for income generation to enable them improving their livelihood standards. Moreover, the downstream dwellers have gained drinking water for their cattle’s during the dry seasons.
Decreasing fertilizer demand

Barley washed-out extract conserves nutrients, thereby reducing the need for chemical fertilizers. These days, the price of fertilizers is continuing to increase from time to time. Moreover, the cost is becoming beyond the purchasing capacity of the smallholder farmers and hence, using the potential of Barley washed-out extract can subsidize the expense for chemical fertilizers.

In AMF, barley is used as a row material. Germination of the grain is carried out under controlled moisture and temperature in the stepping units. Malting involves germination of barley grain until the starchy food-store (endosperm) is available for the development of the germ of the grain smothered by degradation due to enzymatic activities. Malt is therefore, cereal, usually barley, which has germinated for a limited period; growth of the embryo terminated by drying.

Several biochemical and physical changes occur in germination that converts barley into malt. However, some major phenomena, which take place in the steeping process, are the prime source of wastewater in the factory. In the steep, oxygen is in use by the grain and by microorganisms. Thus, the water becomes deoxygenated and the carbon dioxide content increase. However, the barley is washing and aerated during steeping and free from dust especially when the steeping liquors is aerated. Light corns and awns float to the surface and are collect by screening.

As result the steep liquors have a rich solution of microbial nutrients, including amino acids, hexose and pentose, sugars,
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phenolic and simple carboxylic acids and phosphates, are inter-

in to solutions from the husks of intact grains and from the

inferior of damaged, split or half-grains. The dissolve materials

metabolized by microorganisms from the malt husk, with the

consumption of oxygen and the production of acetic acid, and

as a result, the $P_h^+$ of the steep liquor falls. Malt extract is a

multi-component and balanced system of physiologically

active substances of metabolic origin. It is the only product of

vital activity of germinating seeds harmless for the

environment (Kuforidgy, 1994). Study on some biochemical

features of extracts showed that it represents $P_h^+$ range from

4.5-6.0, which contains 0.6 % of dry substances, 2.6 % of

nitrogen, 1.4 % of phosphorous, and 2.1 % of calcium.

In addition, in the extract we can find groups of vitamins such

as B-thiamin, pridioxide, nicotinic acid, inositol, biotin,

ferments of the breathing and oxidizing-restoration complex-
catalase, peroxides, polyphenol oxidase, dehydrogenase,

ascorbicoxidase, hydrolytic ferments-amylase, phosphates,

phytormons- gbberillins, auxins, cytokenes; nucleic acids-
DNA and RNA; amino acid, organic acid carbohydrate, and

other junctions.

Many of these ingredients take active part in the exchange

process of germinating seeds used as an energetic material. The

quality of extract depends a lot on their content and activity

(Naumov, 1987). There are some biological and ecological

functions of egesta/extracts of germinating seeds. The most

important are environment generations, phytosynthetic,

stimulating, inhibitory, protective, reducing and regulatory
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( Naumov, 1987; Kuforidgy. 1994). The action of liquid extract from germinating seeds on the acceptor seeds highly effective (Naumov et al 1987)

The extracts from germinating seeds of donor-cultures make strong stimulating influence on acceptor-seeds, growth, and development of plants, enhance their immunity to different pathogens, and provide the vital capacity of seeds. The positive effect of pre-sowing enrichment with liquid extracts from germinating seeds, form physiological point of view, is that it provides active start/beginning of germination of acceptor seeds.

Barley washed-out extract is a very good potential for agriculture when it is used properly. However, it becomes a wastewater when released to the environment incorporated with other wastes. Many of these ingredients take active part in the exchange process of germinating seeds or they are used as active material. The quality of extract depends a lot on their content and activity (Naumov, 1987). There are some biological and ecological functions of egesta/extracts of germinating seeds. The most important of which is environment generation, photosynthetic, stimulating, inhibitory, protective, reducing, and regulatory. These stimulators are completely new factors not belonging to the category of any mineral or organic fertilizers but functioning as stimulators that are agents on the life of plants. To increase the performance of the crop and pre-sowing fortification of the seeds with malt barley washed-out extract helps to the seeds receive additional quantity of sugar soluble azotic combination.
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and ferments. These substances easily enter into the fetus of either barley or a different crop seed, and help the speedy splitting of the extra substances of the seed itself.

As a result, the absorption of nutritious substances from the soil and the development of the root system are increasing. This water extracts from seeds used as plant bio-stimulator. Such a variety of excretes is necessary to the germination of seeds and, in the future, for the vegetative growth of the plant creating proper physiologically active surrounding, in inter-relation and exchange with the soil micro flora.

According to the Laboratory and field experimental study findings, the barley washed-out extract speeded the germination of seeds, improved the growth and development of root system, increased the absorption of nutritious substances, increased immunity of plants to pathogens and improved the quality of production. In accordance with the laboratory study results, the positive action of liquid extract from germinating seeds on the acceptor seeds highly effective.

The extracts from germinating seeds of donor-cultures make strong stimulating influence on acceptor-seeds, growth, and development of plants, enhance their immunity to different pathogens, and provide the vital capacity of seeds. The positive effect of pre-sowing enrichment with liquid extracts from germinating seeds, form physiological point of view, is that it provides active start/beginning of germination of acceptor seeds.
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This helps the seeds to overcome first stage of germination through

- mobilization of reserve substance of seeds;
- hastening the formation of roots and germs; and
- creating the important bio-chemical environment and micro-flora around the germinating seeds.

Because of full usage of reserve extracts from barley seeds, the active synthesis of nucleic acid, albumin, and others junctions will give a powerful germination growth of shoots and roots of the plant with increased immunity and protect soil borne diseases at the first growth stage of the germinating seeds. In view of the fact that the extract of germinating seeds surrounded them by the biochemical environment with the determined biological activity, which influences the germinating, seeds normally and friendly.

AMF uses barley as a row material. Germination of the grain is carried out under controlled moisture and temperature in the stepping units. Several biochemical and physical changes occur in germination that converts barley into malt. However, some major phenomena, which take place in the steeping process, are the prime source of wastewater in the factory. In the steep, oxygen is quickly taken up by the grain and by microorganisms. Thus, the water becomes deoxygenated and the carbon dioxide content will be increased. When the barley is washed free from dust during steeping and especially when the steep is aerated. Light corns and awns float to the surface and are collect by screening.
The nutrients, including amino acids, hexose and pentose, sugars, phenolic and simple carboxylic acids and phosphates, are inter in to solutions from the husks of intact grains and from the inferior of damaged, split or half-grains. The dissolve materials are metabolized by microorganisms from the malt husk, with the consumption of oxygen and the production of acetic acid, and as a result, the $P_H$ of the steep liquor falls. Proper utilization of the wastewater, there is a need to mix fresh water with the barley washed-out extract/wastewater in order to get a suitable dilution percentage of treated wastewater at 25%, 50%, and 75% depending on the wide-ranging size of the crops and vegetables all with by using a mixing chamber.

**Augmenting fish production**

Once the construction of the ponds is settled and ample water has collected, it will be ideal for fish production. Since a geomembrane plastic sheet covers the ponds, in view of keeping out water percolation there is a need to make additional ponds, which outfitted with proper livelihood atmosphere for fish. It is apparent that fishery will have dual benefits. On the one hand, it increases agricultural productivity per unit volume of water for the surrounding dwellers, while on the other hand, it fosters biodiversity since various varieties of fish can be reared in the two ponds.
Conclusion

Barley, wheat, field pea, and faba bean seeds planted in treated barley washed-out extract of the Asella Malt Factory have performed very well at 25% and 50% dilutions in favor of their intensive growth rate performance of the seeds. These crops also performed well at 75% dilution; however, it has some germination defects on their normal growth rate of the seeds. They also showed unfavorable growth performance at 100% dilution and most of the seeds are not germinated due to the over saturated diffusion of the nutrients.

In the glass pot experiment, it observed that poor growth performance and a distorted structure of plants at 0% of a non-diluted wastewater as control plots was observed on seedling development due to the deficiency of nutrients that could be obtained from the immersed malt barley washed-out extracts.

Vegetable seeds tested with the barley washed-out extract have performed very well at 25% freshwater and 75% barley washed-out extracts of the AM Fin favor of their exhaustive growth rate of the plants.
References


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