

KWAKU DAGBE'S MULTIPURPOSE FARM USE STATION



By

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For

Community Alliance with Family Farmers (CAFF)

For

Small Farms Innovation Challenge 2024

***Sena-** "Simple Solutions for Complex Problems"*

"Whatever the postharvest challenge is or that need of a small scale farmer is, Kwaku Dagbe's Multipurpose Farm Use Station comes in handy"

KWAKU DAGBE'S MULTIPURPOSE FARM USE STATION IN PICTURES



Flipping the sorting/grading platform as a working bench.



Set up of the facility with rechargeable blower.



Constructing the draining basket holder platform for washed produce on the Kwaku Dagbe's Multipurpose Farm Use Station as the sorting/grading platform is flipped to serve as a working bench. Below with two equally splitted 2"x 4" woods cut with $\frac{1}{4}$ " cut grooves to both ends of each for both woods to lock into each other and serve as the produce reject crate stands. To the right with the PCV pipe and a bucket showing is that drain point for the removable bugs trapping sieve which is occasionally removed by un/screwing the union to take out the bug trap to dislodge the bugs and to sort them out into different containers to either release the good bugs to the field or to euthanize them appropriately. Note the cut out ends of the legs to slot into the specially nailed grooves and firm enough not to make the structure wobble.



Set up the Station being used to construct the washed produce baskets holder/drainers which can be seen at both sides of the facility. The sorting/grading platform is flipped and placed over the large sink to use as a working bench. The plexiglass which screens two people working and facing each other had been removed and the poles to the gantry is four feet high and slotted snugly at the ends after cutting one end on all sides to fit into the grooves provided. The light up the gantry is on to brighten the work area. The leaf blower to the left had been connected to the multiple socket extension cord. Depending on the scope of work, the whole gantry including the poles and the leaf blower, the basket holders and drainers could be removed for use as bench as desired. Spills of lubricants or chemicals unto the top of the bench should be avoided as the facility serves foods packaging and could contaminate them. Once it is used, should be thoroughly washed dried, sanitized and covered with a tarp. Note the main water discharge drain 1-1/2" PVC pipe to the right under the station and the connections from the sink and the bug trap.



One of the first models of the Station set up by the Postharvest Center of Tuskegee University to sort and grade cured sweetpotato in front of the curing facility. The mobility of the Station is at play here. You can see the arrangement of crates, the top sides for the wholesome produce handling and the crates below the large blue sink as produce reject crates. The ergonomics of the Station (3 feet high) as workers stand facing each other to work on the harvested produce. The plexiglass to separate two workers to face each other without the fear for contracting respiratory diseases had not been fixed yet. You can see the two hook points on the horizontal long wood. There was no need to fix the drain to the washing sink below as the sweetpotato were only to be sorted and graded.

Bubble Washer Set up for Kwaku Dagbe's Multi-Purpose Farm Use Station.



The leaf blower hanging up to bubble water for washing the crops in the blue sink. I have also used Vacuum Cleaner with a blower as a bubbler to blow air into the water. The bubbling effect depends on the strength of the air being blown. A stronger air gives a stronger bubbling. The farmer would have to choose a strong blower or vac machine. You can see part of the PVC fixture with holes drilled on them at intervals in the sink to serve as a bubbler. The plastic baskets are not the right ones for spinning washed crops in the spinner. This is just to showcase the bubble washing arrangements on the station. The baskets are placed in a dipped draining platform with holes for the platform to drain water from the basket back into the sink. The platform with the baskets are moved to the spinner with the hole points on the platform tilted up slightly to prevent spilling water in the work area to keep the environment dry and neat. To the right beneath the basket drain platform is an opening to channel water through skimming off the floating bugs and debris into the bug trap (stainless sieve container with a clamp lid) where useful bugs are separated from the harmful ones. The useful ones are placed in another container with a screen lid for aeration to be returned to the farm whilst the harmful bugs are disposed into a bigger container with a lid and euthanized with hot water and disposed of appropriately. The wastewater draining from the bugs trap (sits in a bucket with a hole underneath) is connected to the main drainpipe to drain out water without the floating bugs being released back into the environment, an IPM approach to bugs control using the station. A radio can also be connected at the main socket and hang up for the workers to listen to the radio whilst working on the harvested produce.



Transporting the Station to the site for use in a pick-up truck. Those vehicles with hatchbacks as in SUV's with the back seat folded can also be used to transport the Station.



Sorting Bell Peppers on the Farm of She Grows Organic, Tuskegee, Alabama. Note the plexiglass separation and positioning of crates for various produce handling. Not also the collapsible shed over the set up and the tarp on the floor.

The Mobile Multi-Use Station in Pictures

“A One-Stop Facility for Small-Scale Farmers especially”



Pictures from top left to right and down in the same order.

1. Dismantled Station to be loaded into a truck.
2. Participants of students, farmers, faculty and representatives from the National Organic Program, Washington on June 15th, 2022 at the She Grows Organic Farm, Tuskegee where I showcased the Station to them. It was even captured as a photo on their Website: [Exploring New Careers and Growing the Organic Sector | USDA](#).
3. Fixing or removing the plexiglass on the Station.
4. Sorting Bell Pepper at the invitation of She Grows Organic.
5. Using another Station for chicken slaughtering and handling.
6. The sink and sorting platform of the station
7. Flipping the sorting platform and using the back as a working bench in carpentry.
8. A picture pose with the She Grows Organic Farm, Tuskegee

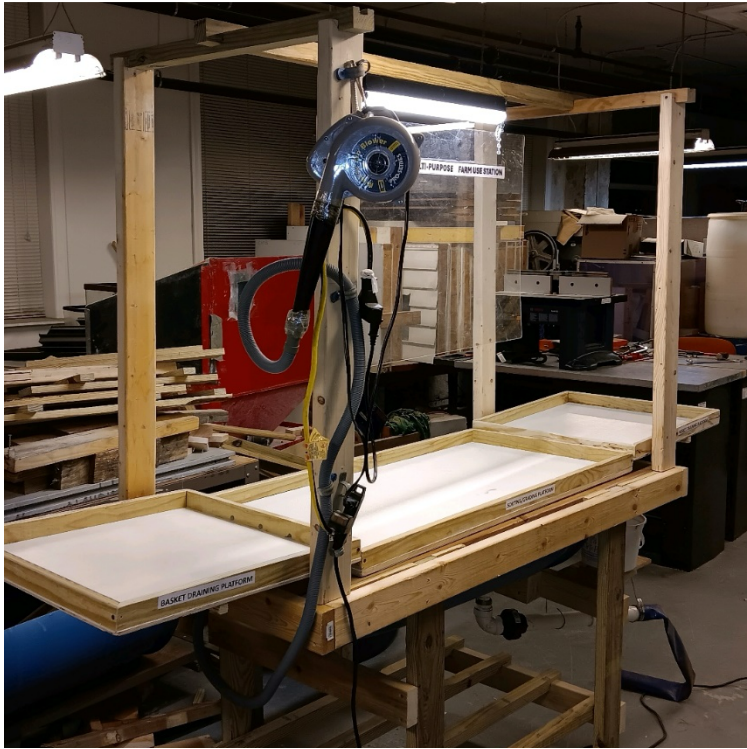


Left. Sorting vegetables on old station. Right. Sorting harvested sweetpoatoes from Tuskegee University

Kwaku Dagbe's Multi-Purpose Farm-Use Station Attributes

- ☐ Helps meet GAP requirements especially by small scale and limited resource farmers ✓
- ☐ Ease of putting facility together in mobile situations ✓
- ☐ Modest and Mobile facility ✓
- ☐ Dismantlable facility. Tying the water/air leak points with strips of bicycle inner tube ✓
- ☐ Lighted working area for thorough visualization of spread produce on platform ✓
- ☐ Ease and effectiveness of use ✓
- ☐ Cheapness of its construction ✓
- ☐ Could be used in the field or for outdoor use ✓
- ☐ Ease of construction and use ✓
- ☐ Grey water recycling for other plants devoid of re-introduction of bugs to the field ✓
- ☐ * Facility for small scale and limited resource farmers especially ✓
- ☐ Water saving facility ✓
- ☐ Environmentally friendly facility ✓
- ☐ Closeness to users on the field if sent there ✓
- ☐ For sorting and grading farm produce ✓
- ☐ For produce washing ✓
- ☐ Facility use as a working bench for basic construction, repairs etc. ✓
- ☐ Facility to save and return useful bugs to the fields ✓
- ☐ Plexiglass screening for user's health facing each other ✓
- ☐ Plexiglass heights adjustability or removable ✓
- ☐ Places to put crates during use ✓
- ☐ Places to put produce reject crates ✓
- ☐ Facility for packaging produce ✓
- ☐ Facility, washable with a drain fixture ✓
- ☐ Facility is protected from the weather especially when not in use covered with tarp ✓
- ☐ Removable PVC fixtures are not glued ✓

CONSTRUCTION OF STRUCTURE USING PICTURES BELOW



Set up for bubble washing. The middle sorting/grading platform is removed to make way for pouring produce to be washed in the large basin. The two draining platforms (24" x 24" and lined with washable wall only on the inside) occupy the produce handling crate points and there is slim wood nailed under it from the far end and the middle portion has three holes drilled to discharge the draining water from the basket after washing the produce into the basin. Both have three holes to drain back into the basin. A small slim piece of wood is nailed under 1/3 from the outer ends makes the platform do dip into the basin. You can see the light/plexiglass gantry with two cross member woods to support it. At the middle point where the 2' x 2" gantry long wood rests on them, both have notches to sit into one another securely. These two cross members woods 2" x 2" that rest on the gantry poles or pillars both have notches to fit into one another snugly. All the notches fitting into each other is to make them fit snugly and to be dismantlable for easy storage and transportation. The notches are about 1/2" deep on all of them.



The bugs/debris trap which is 1-1/2" piped from inside the basin. A hole saw is used to drill a hole after initially filling the basin with water and the meniscus of the filled point is marked with the lowest slope point. A 1-1/2" hole saw is used to drill about 1/2" or 3/4" half below the marked meniscus at the drain side of the basin. Reason, to connect both drainpipes (from the bug trap holder and the basin drainpipe) all into one pipe to drain away. Note the Union which is un/screwed to remove trapped items to take care of the bugs as desired.

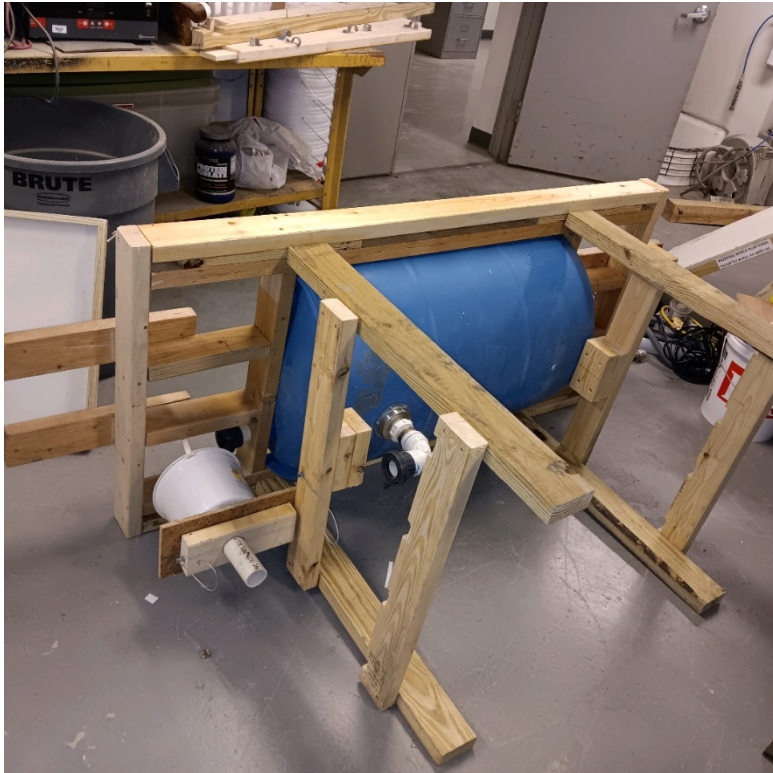


Sorting sweetpotato on one old version of the Station at Tuskegee University. Note the gantry wood which extends a little beyond the cross-member woods which are all 2' X2" thick are used.



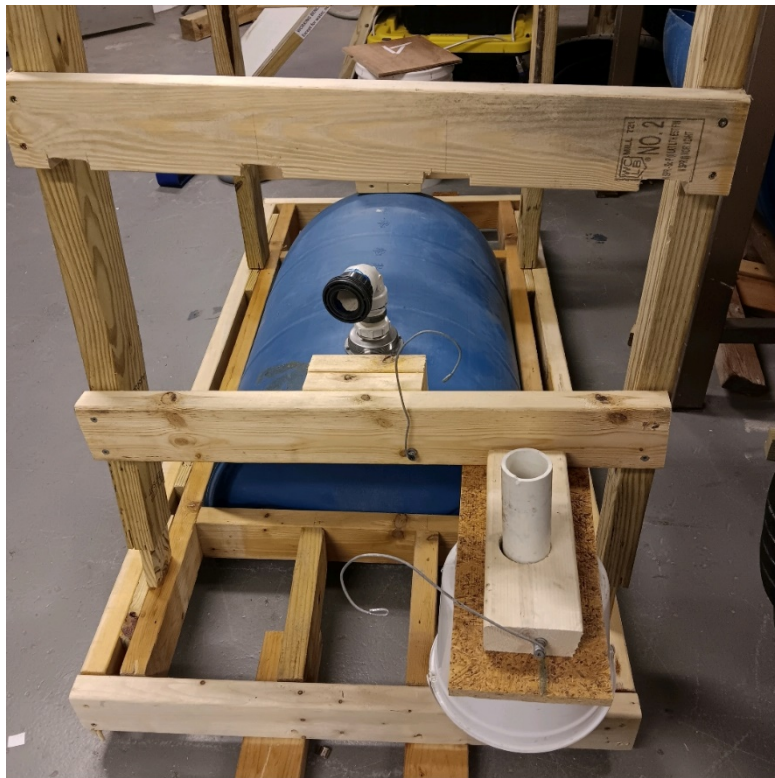
The removable bend glued to a 1-1/2" Union for removal and storage. A point close to one end of the basin is located say 4" away from the side from inside and marked. A sample hole tracing paper provided on the sink drain is measured and the right hole saw is used to cut the right hole at the marked location. If unsure, cardboard is first drilled with the hole to ascertain if it is the right size of the hole to fit the sink drain. The sink drain is fitted after the hole is made as in picture above. An

extended 1-1/2" PVC pipe is connected but not glued. A point on this pipe shall take a 1-1/2" Tee from the Bug trap discharge pipe which will all become one draining pipe to the flexible hose.



The station flipped to the side to show all there is under or by the side. Note the two cross member woods for the legs at the same time, two 6" long 2" x 4" woods are cut and nailed right in the middle of the top cross member wood as shown to support the basin's both ends. On the proximal side or drain opening side is further nailed another piece of wood the same length of the plastic bucket that will house the insect trap with lid as the bug trap which is connected to the 1-1/2" short PVC pipe cut long enough to bend into the middle of the plastic bucket. The other end of the pipe from inside the basin (which was earlier cut with 1-1/2" hole saw at the meniscus will have one of the 1-1/2" Uniseal slotted into the hole and the short cut PVC pipe slotted through to make it leak proof. A 1-1/2" Union is connected outside of the basin close to the wood and another short piece of 1-1/2" PVC pipe is cut and fitted into the other union piece and the other end also fitted snugly into the 1-1/2" elbow. NOTE. All pipe cuttings and fittings should first be done without glueing them to make sure that the pipe that is fitted to the lower end of the elbow plums into the middle of the plastic bucket that holds the insect trap. The bucket should also be taller and wider than the insect trap. The lid to the insect trap shall have a 1-1/2" hole drilled into the exact middle and the second Uniseal fitted into this hole and the lower end of the descending 1-1/2" pipe slotted snugly into the Uniseal. No glueing is necessary here. The base of the trap holding bucket is also drilled with 1-1/2" hole and the third Uniseal applied there. Same size hole is drilled into the supporting wood and a 1-1/2" Short PVC pipe is slotted into through the hole in the wood and through the Uniseal just The other end of the PVC pipe is connected to the top part of the 1-1/2" Tee which also is connected to the same diameter PVC pipe from the kitchen drain pipe. The other end of the Tee takes a slightly long 1-1/2" PVC Pipe say 4" which other end could have the flexible hose slotted to it and secured in place with a hose clamp and the hose

rolled to a water discharge point. The bug trap holder is now connected to the main discharge pipe. As the basin is filled to the brim with the produce to be washed in it and the bubble washer put on, it bubbles and at that time. The water supply pipe could be opened a little to continuously try filling the basin. In the process, floating debris which are agitated are skimmed off through the top discharge point and collected in the insect trap. After a while when no further washing is being done, the Union right by the trap is unscrewed and the insect trap brought out and the content dislodged into another 5-gallon bucket with a lid. The useful insects are sorted with soft tweezers or such into another container which lid should have a hole made and an insect netting placed inside of the cap over the hole and cold glue applied to it. The unwanted bugs could be killed with hot water poured on them and the lid shut and opened after a while before dumping the content appropriately. The useful bugs are returned to the farm to feed on other bugs- Biological control of bugs.



See the Structure turned upside down with unglued fixtures removed. Note also the 6" long by 2" x 4" double wood nailed one after the other to serve as a support for the basin. The second end also has the same. Note the lower legs bracing wood which is notched at four points with equal distance between them for the two pairs of legs which will sit the long woods which ends are also notched about 1/2" deep to fit into each other which supports reject produce crates beneath the station. The metal wire which is bended like a bill hook and nailed to that wood support for the bug trap bucket is what supports or hold the longer pipe in check as it is connected to the flexible at the end.



Initially, I used a leaf blower to give air to the bubbler. Later I started to use the HVac and the stronger the HVac, the stronger the bubbling. You can also see the insect trap housing or bucket into which fits (not sitting though) the bug trap. It is unscrewed from the union and the debris cum insects discharged into other containers. You can see how the legs are braced at the sides and the lower bracing having notches (on tops) into which fits the horizontal wood planks as produce reject crates stands which ends and under also have notches to fit into the lower legs cross member notches. Note also the three platforms. The middle one is for sorting grading or whatever and lined with washable wall inside and outside. The plexiglass connected on a 12" chain on both sides as small holes are drilled into the two topmost parts equidistant from the middle and fitted with Quick Links and connected to one end of the two chains.



The extended 1-1/2" PVC pipe which are not glued and could be connected to flexible hose to discharge water as desired.



The 24" square Bubble washed draining basket holder with three holes drilled right above the plexiglass which is place at both sides of the station with the holes position to drain water back into the basin. Only one side has the plexiglass.



The Sorting/ Grading Platform which has both sides fitted with plexiglass. That of the back with plexiglass is needed to avoid soiling the back of the platform especially when it is flipped with the back serving as a working bench or platform during repairs or construction equipment or such by the farmer or whoever. The spill can easily be washed off with the appropriate material and sanitized if need be. To be able to nail the side woods appropriately, first the plywood is cut to the dimensions and the washable wall also cut to the same dimensions. A small amount of glue is applied to the center area of the plywood and the washable wall placed over it to dry. The same is repeated for the second side of the of the sorting platform. For the Basked holders, only one side is required so glue is applied to only one side. After they are dried. The side 1" X 2" wood is cut to the desired lengths by the sides and placed at the edges of the washable wall. The right type of drill bit is used which thickness should be smaller than the screws to use. A 1-1/2" screw is later used at all drilled points to fasten the side woods into place without any crevices to leak water. The same if repeated for all sides. I prefer to cut the ends at a 45° angle for both sides to fit without leaking. No further glue is



Legend

1. 2"x4"x 48" long 4 pcs gantry to support horizontal wooden cross member. The bottom parts are cut as Tenon to slot into Mortise space by the sides of structure.
2. 1-1/2" Tee connecting the bug trap drain to the sink drain
3. 1-1/2" elbow of the drain
4. Produce Reject crates support woods (3 or 4 pieces) and notched to sit into the horizontal wooden brace of legs which are also notched on both pairs of legs.

needed as it is food grade equipment being constructed. That with only one side have the same nailing procedure.



Construction of the main frame of the Station using sturdy 2' X 4" woods.

Inner longer two sides of wood cut at 60" long for all two.

Width of inner side woods cut at 23" for the width of two sides.

All four woods are placed right angle to each other at the perimeter of the cut into half drum and nailed leaving 11' each on either side of the long one.

The longer 1" X 4" is cut at 9-1/2" long and placed where the shorter width wood is perpendicular to the nailed longer woods. It is nailed in place with 3-1/2 "nails on all four sides. The Tenon ends of the leg is placed right by the flat 9-1/2". Inside of the longer length side is placed close by it the flat cut 1" X 4" which is cut at 4-1/2" to flush with one side of the tenon of the leg. Nails are applied making sure the tenon portion of the leg can be slotted in and out without difficulty but not loose enough to make the legs wobble. Same is repeated for all other three legs. The other two longer side woods are also nailed on top of the flat woods. Now the longer width woods 30-1/4" are also nailed perpendicular to the longer nailed side woods. Four 11" cut woods are also made and positioned into the extended sides with three equal distances between them and nailed to the longer side wood of length 30-3/4". The same is repeated at the second side as they serve as caret points by the sides of the structure. Four 16" woods are cut and nailed on the 11" cut and nailed woods flat leaving 5" spacing from the shorter width wood so that they extend out to support wider crates sitting on them. It is repeated for all four. All the legs tenons are slotted in their constructed mortices and they should not be too free to enter or to come out. Two cross member woods are cut first to brace a pair of legs into position 6" from the floor. Same is repeated for the other side. The second top bracing is determined after the cut half gallon is placed into the space is created inside the structure and nailed from inside all around. The whole structure is flipped and the legs slotted face up into the space and pushed to sit firmly. At this point, the second bracing wood is placed right on the base of the drum and levelled and nailed on the two sides of the legs. Same is repeated for the second pair of legs. The cut 6" long piece

of wood is placed flushing with the base of the drum and nailed to the bracing wood another piece is again nailed unto the first one. Same is done to the other side. They serve as support to the base of the drum.

You can see the Tenon part of the leg which slots into the created mortise. First the following apply:

Tenon length = Mortise Depth (the slot or hole into which the leg enters or slots)

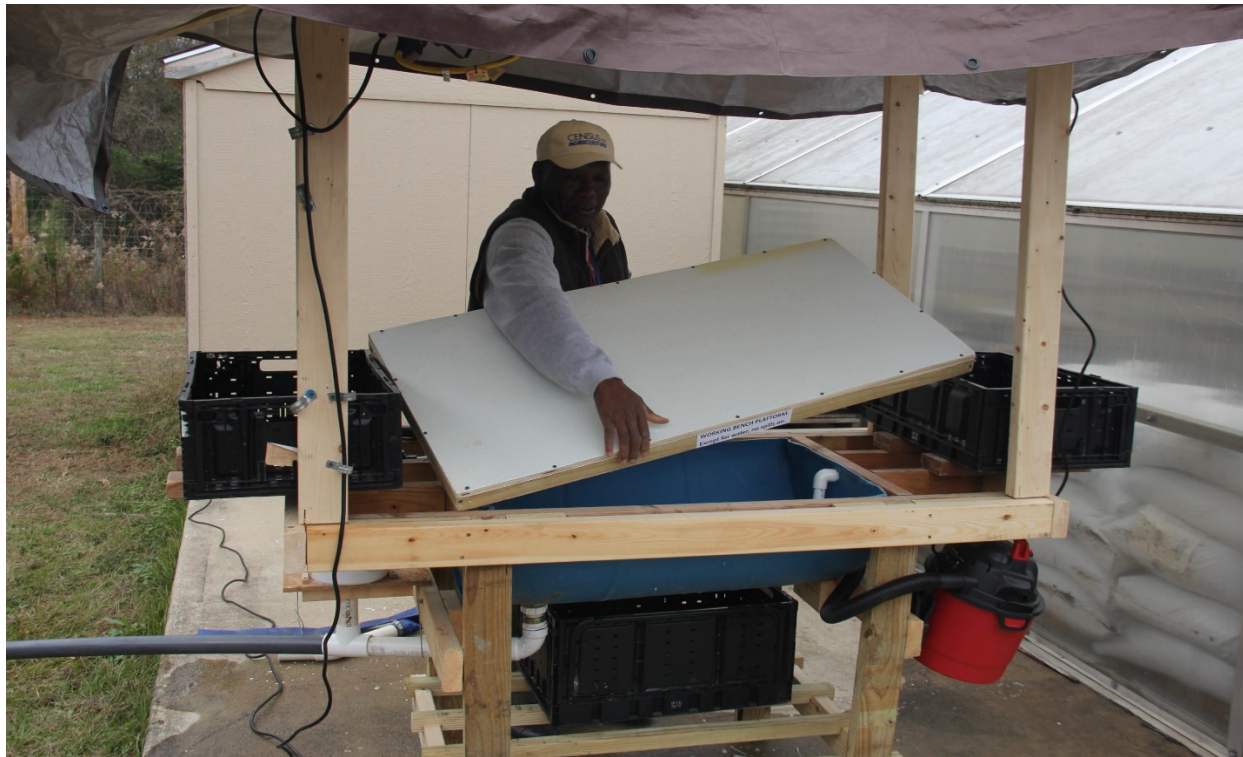
Tenon Width = Mortise Length

Tenon Thickness = Mortise Width, I got as the thickness of the 1" x 4" wood which I cut that to the right at length 4-1/2" for all four inner ones which are just before the legs. After naili

The Tenon is what remains after the sides to one side of the leg is cut off. See it slightly protruding out.



This is how the crate rejects stand look. As the structure stands, four 2' X 2" woods are measured leaving a little elongation at both ends of about 1-1/2" as seen in the picture. They are measured to have equal spacing between them and are notched 1/2" deep and the lower cross member wood for the legs are also notched for them to sit into one another. Same is done to the other side.



Mounting the structure as in Picture. A 2-4 or 5 Gallon Hvac is bought and mounted by the side as shown. The air discharge hose is connected to the 1/3" extended PVC pipe outside and both ends as one slots into the other is tied firmly with cut strips of bicycle inner tube to prevent air leak. The powers cables are connected to a switch and the HVac cord connected to it. The 2' fluorescent lamp is also fitted using small screws to be located under the horizontal gantry by marking first in the middle of the gantry where the hook points in the light frame are and the screws put in and the light hooked to it and connected to the supply line. The flight should have a switch on it separately. The whole setup is as shown. People can buy a collapsible canopy to put over it. The structure is ready for sorting or whatever. If bubble washing is required, the HVac is placed in position and connected and water filled into the basin with garden hose which when full should have the tap turn low to give a constant supply of water to help in skimming as bubble washing goes on.

KWAKU DAGBE'S MULTIPURPOSE FARM USE STATION CONSTRUCTION FIXTURES AND PRICES FROM HOME DEPOT

NB Woods should be untreated with chemicals as they shall be used in food handling. They can be kiln dried

Some prices when bought as groups shall be reduced drastically e.g. Drum. Only half is needed. Total Amount \$721.51

	Items	Qty.	Unit Cost (\$)	Total Cost (\$)
1.	2" x 4"x 96" Wood	10	9.98	99.8
2.	Plexiglass (36" x 24")	1	55.74	55.74
3.	Metal Chain 12" long to hang plexiglass	2	0.72	1.44
4.	Quick Links for the chain and plexiglass	2	4.59	9.81
5.	Screw Eyes	2	2.39	4.87
6.	1-1/2" Hose Clip to secure waste pipe	1	3.69	3.69
7.	1-1/2" PVC short pipe for wastewater	2	8.49	16.98
8.	1-1/2" Uniseal Rubber for sealing holes & pipes	3	2.47	7.41
9.	Vevor 1-1/2 Flexible Hose for water discharge (By Farmer)	1	35.99	35.99
10.	1-1/2" PVC Union	2	8.29	16.58
11.	1-1/2" PVC Elbow	4	2.99	11.96
12.	1-1/2" PVC 72415	1	5.49	5.49
13.	1-1/2" PVC Tee	1	4.89	4.89
14.	Bas Pro Shops Cricket Basket as bugs trap	1	9.99	9.99
15.	Teflon Thread tape	1	0.99	0.99
16.	Sink Drain Basket, Turn and Seal	1	18.99	18.99
17.	1-1/2" Slip Joint	1	3.19	3.19
18.	1/2" thick water- resistant plywood	1	48.79	48.79
19.	3-1/2 Wood Screws (60/Box)	1	12.99	12.99
20.	2-1/2 Wood Screws (60/Box)	1	12.99	12.99
21.	1/2" Wood Screw (60/Box)	1	12.99	12.99
22.	PVC Glue, Small Container	1	6.79	6.79
23.	Wood Glue, Small Container	1	4.65	4.65
24.	Glasliner Washable Wall	1	41.98	41.98
25.	1-1/2" Sink Tail Piece	1	4.29	4.29
26.	Galvanize Metal Wire	1	4.29	4.29
27.	New 55 Gallon Plastic Drum	1	150.99	150.99
28.	1" x 4" X 96" Wood	1	6.48	6.48
29.	2 Gallon Round Bottom Plastic Bucket	1	8.78	8.78
30.	2" X 2" X 96" Wood	5	3.12	15.60
31.	HVac 2 gallon	1	50.29	50.29
32.	Plug in Cord with switch	1	11.59	11.59
33.	2' fluorescent light with cover and switch	1	20.21	20.21

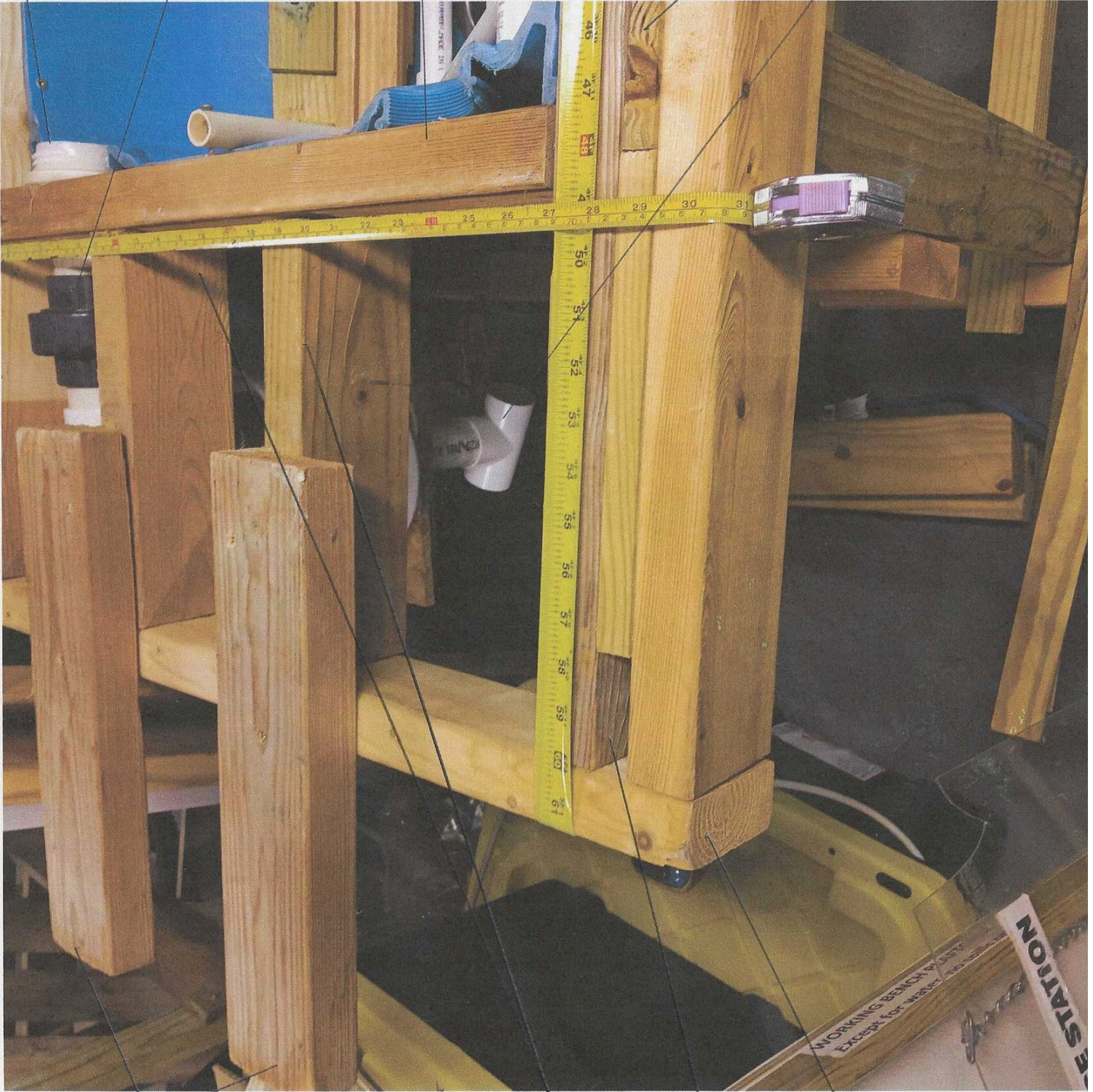
Water
Skimming
point

Union
to remove
bug trap

shorter
wood for
width
drum
support
23"

leg slot

1-1/2" PVC
Tee to
Connect
bug discharge
to main
drain pipe



Crates
support
woods
Cut 14"

bracing for
Crates
11" long

Center pole
slot for
top here

End
bracing for
structure
30 1/4" long

THE BUBBLER CONSTRUCTION AND JOINERY WITHOUT GLUEING Floating debris FOR DISMANTLING AND CLEANING Skim hole



PVC pipe to hold
the bubbler in
the water

cut $\frac{3}{2}$ " PVC pipe
joined to pipe
to submerge the
bubbler and can be
pried open to remove bubbler.

PVC pipes cut at 9"
and small holes drilled
on them

$\frac{3}{4}$ " Elbow joined to
 $\frac{3}{4}$ " pipe and
connected tightly
to the hose on the
H-Vac to blow
air into water.

LEGEND. $\frac{3}{4}$ " fittings used throughout. (PVC)

$\frac{3}{4}$ " Pipe cut	= 3
9" ~ ~ ~	= 8
5" ~ ~ ~	= 2
Elbow (E) NC	= 6
Tree (T) PVC	= 5