

Northeast SARE Farmer Grant
Final Report for Project FNE07-600
Crop Planning Software for Small, Diversified Farms

1. Project name and contact information

Project Title: Crop Planning Software for Small, Diversified Farms

Project Leader: Clayton Carter

Address: 41 Puls Ln, Montville, ME 04941

Telephone: 207-342-2770

Best time to call: Any time

E-mail address: crcarter@alumni.indiana.edu

2. Goals

As outlined in our 2007 grant application, we sought to create a software package that would allow users to easily create and manipulate crop plans for their small, diversified farms. This grant would see the project through to a “Beta” (or “almost ready for everyone to use”) release state as well as fund the creation of a project website and several presentations across the Northeast.

3. Farm profile

Fail Better Farm is a small, certified organic, diversified vegetable farm located in central Maine. In 2008, we had $\frac{3}{4}$ acre in cash crops and $1\frac{1}{2}$ acres in cover crops with our produce being sold through farmers markets, to local restaurants and through a small CSA. Our production model is based on intensive cultivation of crops laid out in beds which are cropped at least once and generally twice per season. In 2006 and 2007, our farm was located on the grounds of the Maine Organic Farmers and Gardener's Association's (MOFGA) Common Ground Country Fair in Unity, ME, where we served as MOFGA's Farmers-in-Residence. In the winter of 2007, we ended our tenure at MOFGA and moved our farm just down the road to Montville, ME where we are working with another family to reclaim and rebuild an old farm. For the 2009 growing season, we will be growing 1 acre of cash crops and 1 acre of cover crops. Our produce will be sold at farmers markets, to several area restaurants and through our CSA.

4. Participants

Andrew Marshall, Educational Programs Director at MOFGA, served as our technical advisor for this project. In addition to his help in encouraging us to undertake this project and in its planning, he served as a sounding board for ideas and as a early program tester.

5. Project activities

The primary activities involved in this project were planning, designing and then implementing the software. Which is to say: a lot of desk time.

We wrote the software in the Java programming language because it is widely supported and allows a program to be written once and run on any modern computer without modification. (Though some computers may require a one time download to enable Java support.)

The software was envisioned early on as a “master/detail desktop database” application which would allow users to benefit from the power of a relational database without having to have specific – or any – knowledge of the database. A “master/detail” application is one that presents two visual components: a condensed list of entries and some of their data in tabular format (the “master” list) and an expanded display of a single entry and all of its data (the “detail” portion). This display format allows users to work with large numbers of entries without getting bogged down in the details, but it still allows them quick access to those details when they need them. The decision to use a database for primary data storage was a critical one because it allowed us to keep the data and the “logic” (ie, calculations, interfaces, output, etc) separate. One of our primary complaints about spreadsheets is that the data and the logic are not only inseparable, but often indistinguishable. Because the program was structured this way, it was very easy – for example – to add the ability to import from and export to different data formats such as comma separated text values (CSV) or spreadsheets (Microsoft Excel, or XLS).

Another decision that we made early on and stuck to was that the program should do no printing in and of itself, but that it should create PDF files (or Portable Document Format files) which could themselves be viewed or printed. We felt that support for PDF files was common enough that including print support in the program would introduce an unnecessary layer of complexity. We are very happy with this decision: the program generates PDF files which users can then file for reference or view and/or print with software they already have installed, such as Adobe Acrobat Reader. In addition, this approach will help users to save paper by allowing them to preview the files before they're printed.

We established a website for the project with the Google Code service. (See <http://code.google.com/>) This is a free service for open source software projects and provides a number of features which have made it very easy to provide the software and help documentation to users, as well as to encourage involvement in the project. This service is targeted at developers rather than end users, however, and we have had to make compromises in order to make it easier for casual users to navigate. We will likely create another website targeted solely at end users (and not programmers or developers) at some point in the future.

Our group outreach program has been delayed in accordance with our delayed release schedule. To date, we have spoken directly and via email with numerous growers and users of the software, hosted a group presentation and discussion at the 2007 New England Vegetable and Fruit Growers Conference in Manchester, NH and offered several presentations (with lively question and answer periods) at the 2008 Common Ground Country Fair in Unity, ME. Now that the software is functional and in a download-able, use-able state, these group outreach activities will pick up a bit. Please see our final report on outreach, item #11, for more information.

6. Results

In February of 2008, the project's website went “live” and we made the first public release of the software which had been our goal for over a year. Since then, the software has seen one minor revision in the Spring and a major revision in the Fall. The website has been visited over 1500 times (from 80 countries on 6 continents, through most visits are from New England and the American Southwest) and the software has been downloaded over 800 times (cumulative for all versions; the latest version was downloaded almost 150 times during its first month of availability). As detailed in our project application, the software was released as open source, free software, which means that the program is and will always be free for all to download and use.

The software, as currently released:

- keeps a database of crops and varieties, including statistics used to plan plantings and yield
 - when separate entries are maintained for a crop and varieties of that crop (ie “Peppers”, “Peppers, Fat n Sassy” and “Peppers, Red Knight”), statistics which are left blank in the entries for the *varieties* are automatically filled in with the corresponding statistic from the *crop* entry. This is done dynamically, so if the value for the *crop* is changed, the value for the *variety* will automatically reflect the change.
 - For example, say you create an entry and you set the *crop name* to “Peppers” and set the *yield per foot* to *1.5 lbs*.
 - Now you create another entry where you set the *crop name* to “Peppers” and the *variety name* to “Fat n Sassy”, but you don't enter a value for *yield per foot*. When you save the new entry, the *yield per foot* will automatically display the value that you recorded under “Peppers”.
 - Statistics or properties tracked for crops and varieties include: maturity days, direct seeded and/or transplanted, rows per bed, row spacing, in-row spacing, flat size (for greenhouse (GH) sowing), planter setting, yield per row foot, value per yield unit.
- keeps any number of user defined crop plans
 - crop plans are really just lists of “plantings”
 - if a planting is of a crop or variety which exists in the crop database, then any blank properties are automatically filled in with the corresponding properties from that crop or varieties entry in the crop database. As with crop→variety “inheritance”, this is dynamic and any changes in the crop database will automatically be reflected in the crop plan.
 - For example, if you create a crop plan which contains a planting of 100 rowfeet of “Fat n Sassy Peppers” (from our previous example), you will see the value for *yield per foot* displayed as it was entered in the crop database. (From our previous example: *1.5 lbs*) If you later realize that “Fat n Sassy” actually yields 2# per foot for you, you can change that value in the crop database and the new value will be reflected in your crop plan.
 - Plantings feature numerous automatic calculations:
 - the software tracks three dates: planting/seeding date, transplanting date and harvest date. Enter any one of these dates and the software will – assuming the other requisite figures have been entered (ie, maturity days, days from seeding to transplant, etc) – automatically calculate the other two.

- This allows a farmer to easily work around their frost dates (eg, enter the date for which it is safe to transplant a crop outside) or to plan for a market or CSA (eg, enter the date you wish to harvest and the program will calculate the other dates and tell you when you need to seed or plant).
- In addition to the planned dates, the program also allows users to track the actual dates on which things happen.
 - For example, if you had planned to plant onions in the greenhouse on March 2nd but didn't actually get to it until March 10th, you can enter this into the program and it will recalculate the date when they should be ready for transplanting.
- The amount to plant is automatically calculated. The software tracks the following statistics about “amounts”: beds to plant, row-feet to plant, plants needed, GH flats to start and total yield. Enter any one of these properties and the software will – assuming the other requisite properties have been entered (ie, rows per bed, in-row spacing, GH flat size, etc) – automatically calculate the others. This gives growers great flexibility in determining how much they need to plant. (For example: “2 beds of carrots” or “100 heads of lettuce” or “150 tomatoes”, etc.)
- Statistics or properties tracked for plantings include all those tracked for crops and varieties, plus: location; planting, transplanting and harvest dates; beds, rowfeet, GH flats and plants to plant; estimate of total yield.
- Both the crop database and the crop plans are easily manipulable
 - columns can be hidden or shown simply by right clicking on the table header
 - each column is sortable simply by clicking on the column header
 - the tables can be filtered to limit the display to only entries which match the filter. (for example, “tomatoes”, “black plastic”, “radish april”)
 - these seemingly simple features effectively end the overwhelming nature from which the many spreadsheet based crop plans suffer. With a few clicks or keystrokes, any entry can be located and displayed with only the information which the user cares about.
- With a crop plan in place, the user can generate weekly (or monthly) lists – in PDF format, ready for printing – of what to plant, when and how much to plant, and where and how to plant it.
 - These lists can then be used for record keeping, allowing the farmer to just check off an entry w/ a date and any notes or modifications. This can then serve as the “planting records” which are required for organic certification.
 - Two lists are currently generated: greenhouse (GH) seedings and field plantings, which itself is two lists: one list is for direct seeded field plantings and the other is for transplanted field plantings. These lists include properties for each planting which tell the farmer how much to plant and how to plant it; all of which is based upon the crop plan that the farmer previously created.

- Plantings can then be checked off as “planted”, “transplanted” and/or “harvested”, giving us a simple visual method of seeing what has already been done as well as a datum which we can use for advanced filtering. (eg, if a planting list is generated at the start of the week and then regenerated in the middle of the week, it will not include plantings which have been checked off as “planted” during the interim.)
- Additionally, plantings can be marked as “ignored” or “skipped” for the inevitable case when we just can't get everything done. These aren't deleted, they're simply hidden. This keeps us from feeling bad about all of the things we haven't been able to do, but also allows us to evaluate why they were skipped when we get to the end of the season.
- The software is written in Java, which means that any reasonably recent computer can run it. Users of Macs can simply download the software and run it, while Windows users may have to download a copy of Java before they can use the software. (Instructions for doing so are provided on the website.)
 - Pains have been taken to ensure the users can easily upgrade when new versions are available. The software is able to detect when the data file needs to be updated and is able to do so without the user noticing.
- A “wizard” or guided setup process helps users get setup and started fast.

These results are more or less in line with the desired results as set forth in our grant application with the exception that we did not come to these results as quickly as we had thought we might. Two culprits are to blame: personally, we moved and had a baby in the late fall and early of 2007 and these events did not allow me to work on the project as much as I would have liked; and, professionally, we feel that our original estimate of the complexity of the project and time needed to bring it to finished or nearly finished state was dramatically underestimated. We had originally hoped to see the software through to a “beta” (or “almost ready for unqualified release”) release phase during early 2008, but this did not happen until the late fall.

7. Conditions – N/A

8. Economics – N/A

9. Assessment

As we worked on this project we were surprised at how often we reassessed our targets and changed direction on particular features, interfaces or implementations. This was frustrating when we had already spent a lot of time working on something, but in the end it has produced a software package that is better for it. Most of these reassessments involved moves on our behalf to make the program code more “abstract”, which is to say that we had written it in a way where particular pieces were closely tied together and we would rework them so that they were less tightly coupled, more flexible and easier to augment and maintain. A couple of examples:

- From the outset, we had assumed that crops could be direct seeded OR transplanted, but not both. For crops which could be both transplanted or direct seeded, we assumed that a particular farm would only use one method. We reassessed, however, and made some

intricate modifications to the software to allow users to record different planting statistics for the different planting methods. They could then add plantings of these crops to their crop plan and specify whether the crop in question is to be direct seeded or transplanted. The software will use this information to adjust the calculations that it makes. (Many growers will sow their earliest crops by transplant even if they sow their subsequent plantings directly; think of spinach, sweet corn or summer squash.)

- Many features which had been planned for these early releases have been pushed back on the timeline. Seed ordering and tracking of actual yields are two such features. We chose to focus on the day-to-day functions that the software would be performing during the growing season and to wait until next fall or winter to add seed ordering and yield tracking capabilities.
- Early feedback from users indicated that there were many parts of the program which were far from intuitive and we have focused on these issues as we approach “version 1.0”. In particular, we have implemented a “wizard” which guides new users through the initial setup of the program. After starting the program for the first time and completing 3-4 guided setup steps, the program is left in a state such that users can start entering data immediately. Additionally, we are working to add more explanatory documentation to the website and to simplify and “unconfuse” the programs interface. All of these changes are based on direct user feedback.

As of this writing, we feel that the feature set of the program is complete enough to be *useful*. As such, we are focusing our efforts (and those of volunteers) on making the program more *usable*. This includes fixing bugs, adjusting the layout and interface and generally polishing the program. From there, our focus will shift to the addition of some major new features such as:

- improved CSA and market harvest planning: providing an interface that will simplify and integrate the process of preplanning weekly harvests based on the number of shares or desired yield/volume
- integrated yield tracking (tracking actual yields vs the yield estimation that is already in place)
- end-of-season crop plan evaluation: what worked, what didn't, what wasn't on time, what wasn't enough or what was too much. Then use this information to generate next season's crop plan from this season's.
- “sanity checks” for frost dates, greenhouse space, field space, etc. These checks would use simple data from the user (such as when their last and first frosts occur, how many flats fit in their greenhouse, how many rows or beds fit in each field, etc) to double check crop plans against these constraints and prevent users from inadvertently planning to do something like planning to plant more beds than will actually fit in a field or planting their tomatoes too early.
- crop “todo lists”: series of tasks for each crop, including when they need to be done and how long they take. This information could then be used to generate weekly task lists (eg, “lay black plastic 3 weeks before transplanting (30 minutes, 2 people)” or “cultivate (stale seedbed) 1 week before planting (15 minutes, 1 person)” or “flame weed 5 days after planting (10 minutes, 1 person)”) which could be used to provide reminders, thus improving management, as well as helping growers to estimate their labor needs for the season.

10. Adoption

As mentioned earlier, the software has been downloaded over 800 times as of this writing. Though detailed feedback from users has been scant, we have received several comments along the lines of “Hey, this is great!”. As we communicate with growers who are actively using the software, we get the impression that they are excited by what it can do, but eager for it to do more and to do what it already does in a more simple manner.

Speaking as “early adopters” ourselves, we can say that the software was a huge boon to us during this past season. We used the software as our only crop planning tool for the season and this past season was also our first where management of plantings (when, where and how much) was no longer the biggest hurdle to production. It encouraged us to think hard about what and when we wanted to plant and how and how much we wanted to plant before the season even started. Most of our plantings were planned by specifying an arbitrary number of beds to plant, but others were scaled by entering a desired yield and letting the software tell us how much to plant. Moreover, we took full advantage of the automatic date calculations by scheduling some plantings based on a desired planting date, some on a desired transplant date and others on a desired harvest date. It then made it easy for us to access that information so that we didn't have to spend more time thinking about it; we could just look at the print out and – knowing that we had already made the decisions – trust that we would be fine if we just did what the print out told us to do. It is clear to us that the potential of this software is great and we feel committed to continuing to develop and improve it.

When we asked a user (who is in the process of starting her own farm) if she could write a brief statement about how she's used the software, what she doesn't like about it and what she does like about it, she responded:

“This software was really helpful for me, not only in planning plantings, but in helping me visualize my schedule for the season. I love being able to print out a week's schedule of seeding and transplanting. I wanted to be able to organize my plantings in this way, but could never figure out how to do it on paper. Being able to compile crop data in with schedules was also really helpful and saved me a lot of time. ... I will definitely use it again!” –Christa in ME

We have also received other informal testimonials:

“I just downloaded the crop planning software and I'm looking forward to evaluating it. ... I'll provide feedback soon, and thanks a lot for taking the initiative to do this.” –Michael in VT

“So glad to have found you! I'm an IT guy who is starting up a small farm organic farm in NC in my spare time. I've been working on a farm plan with my buddy but it started to seem like there had to be a better way - ie, a database. I started to create it, but then realized *surely* somebody else has had this same problem and maybe there is an open source project I could throw in with. I was getting discouraged Googling around when I finally ran across your project. I realize you are in the very early goings but I'm excited to see that something like this is underway.” –Sam in NC

11.Outreach

Because of our adjusted timeline for release of the software, our outreach plan was also adjusted. In 2007, we wrote an article for MOFGA's newspaper, the MOF&G, detailing the concepts behind the software, and we hosted a well attended presentation at the 2007 New England Vegetable and Fruit Growers Conference that served to present the concept of the software, to solicit ideas about how the software could be most useful to growers and that also served as a roundtable discussion about crop planning on modern, diversified farms. (At the time of the MOF&G article and the NEVFC presentation, the software was not yet available.) In 2008, we hosted several presentations and demonstrations of the software at MOFGA's annual Common Ground County Fair. Perhaps most extensively, however, we created a website to host the development and distribution of the software package, as well as to disseminate information about how to use the software. As mentioned before, the website has been visited over 1500 times. The URL for this webpage is <http://cropplanning.googlecode.com>.

For the future, we have contacted the Pennsylvania Association for Sustainable Agriculture about presenting the software at their 2009 winter conference, we have been approached by the Northeast Organic Farming Association of Massachusetts about presenting the software at their 2009 summer conference, we are scheduled to give presentations to MOFGA certified growers during a couple of "Growers Meetings" they are hosting across the state, we are planning on presenting the software and participate in a roundtable discussion on crop planning with the Eastern Massachusetts Collaborative Regional Alliance for Farmer Training (EMASS-CRAFT), we are planning to write another article for the MOF&G which will focus on some of the cool stuff the software can do, and we hope to soon contact the NOFA newspaper, the Natural Farmer, about publishing an article with them as well.

While this outreach doesn't quite match the outreach plan from our application, we feel confident that we have been faithful to that plan, if not its time frame. In addition, we are committed to seeing the original outreach plan to completion as well as carrying it further. We have worked hard on this project, we're very proud of our accomplishments and we're eager to share with other growers how they can benefit from this. We are excited to shout this over hill and dale.

12.Report Summary

This project has created software that allows operators of small, diversified farms to create better crop plans that are detailed and easy to work with.

The software was written in the Java programming language, which allows it to run on any modern computer, and was structured around a database that would allow entries to be sorted, filtered, updated, duplicated, shared, created and deleted. The simple interface allows users to create entries for crops and varieties of those crops and to enter planting yield and cultural information about those crops and varieties. Users can then create crop plans which are just scheduled plantings of the already entered crops and varieties. Many properties can be shared between crops, varieties and plantings or can be specifically set for each entry and many properties can be automatically calculated based on other properties, including planting and harvest dates, potential yield and the number of beds or rowfeet necessary to achieve that yield. Finally, users can export their crop plans as a periodic planting list which includes all data relevant to where, when and how much to plant and is ready to be printed and taken to the field or greenhouse.

A website has been created which allows users to learn about the software and to download it for use. This website is located at <http://cropplanning.googlecode.com/>. This project has seen the software through its earliest development stages and, while it is by no means finished, it's in a state where it is usable and publicly available. User feedback has been positive and we feel that the potential for this software is just beginning to be tapped.

13. Attachments

Attached, you will find a print out of the article we wrote for Summer 2007 issue of MOFGA's newspaper, the Maine Organic Farmer and Gardener as well as a print out of one of the web pages we created to show images of the software in action and to demonstrate some of its more advanced features.

Clayton Carter
Fail Better Farm
January 21, 2009