TOOL BOX FOR WORKING WITH ROOT, TUBER AND BANANA SEED SYSTEMS

RTB User Guide

Experimental auctions

User Guide to Experimental Auctions of Vegetatively Propagated Seed

Erik Delaquis, Fleur B. M. Kilwinger, Vanya Slavchevska, Srinivasulu Rajendran, Enoch Kikulwe, Jonathan C. Newby

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www.rtb.cgiar.org

Contact:
RTB Program Management Unit
International Potato Center (CIP)
Apartado 1558, Lima 12, Peru
rtb@cgiar.org • www.rtb.cgiar.org

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Contents

Acronyms

ACIAR	Australian Center for International Agricultural Research
BDM	Becker, DeGroot and Marschak (auctions)
CIP	Centro Internacional de la Papa (International Potato Center)
RTB	CGIAR Research Program on Roots, Tubers and Bananas
WTA	Willingness to accept
WTP	Willingness to pay
WUR	Wageningen University & Research

Abstract

Experimental auctions are used to understand the value of different products to consumers through estimations of willingness to pay (WTP). This information is valuable for many reasons, from obtaining local prices attached to seed traits to informing seed businesses about acceptable production costs. Experimental auctions do a better job of estimating this than simple questionnaires or surveys. By engaging participants actively, experimental auctions lead to real or hypothetical consequences that make people think and act carefully according to their personal preferences. This user guide provides an overview of different types of experimental auctions and their use in seed system research. The guide discusses the structure of auctions, planning and conducting them, and lessons from the field. Reading this guide will help you to be prepared to design and implement an auction in your own project or intervention.

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Author affiliations

In alphabetical order by last name:

Erik Delaquis Alliance of Bioversity International and CIAT, Vientiane, Lao P.D.R.; Wageningen University and Research (WUR), Wageningen, The Netherlands

Enock Kikulwe Alliance of Bioversity International and CIAT, Kampala, Uganda

Fleur B. M. Kilwinger Wageningen University and Research, Wageningen (WUR), The Netherlands

Jonathan C. Newby Alliance of Bioversity International and CIAT, Vientiane, Lao P.D.R.

Srinivasulu Rajendran International Potato Center (CIP), Kampala, Uganda

Vanya Slavchevska Alliance of Bioversity International and CIAT, Cali, Colombia

User Guide to Experimental Auctions of Vegetatively Propagated Seed

1. INTRODUCTION

Improving the production of root, tuber and banana crops is hindered by poor access to quality planting material. Farmers mainly recycle their planting material and source it via unregulated channels often called the 'informal', 'local', or 'farmer' seed system. This provides farmers with seed of locally adapted and desired varieties, but can increase the risk of build-up and spread of diseases, causing actual yields to fall below their potential. Informal systems may also lack access to new varieties originating outside their local network. Most seed system interventions aim to improve farmers' access to high quality planting materials and new varieties. Hence, understanding demand for seed is key for designing seed system interventions. When there is no demand, there will be no adoption.

Many developing country governments, non-governmental organizations and development projects develop, produce, and supply improved seed, often subsidized or free of charge (Okello et al. 2015; Ogero et al. 2016; Bentley et al. 2018). Giving seed away or subsidizing it can be expensive and economically unsustainable (Labarta 2009). Ill-designed seed aid can also actually increase farmers' vulnerability (Sperling et al. 2008). In the short-term, poorly designed initiatives can cause farmers to waste scarce resources like land and labor on maladapted varieties. In the long-term, farmers may become dependent on subsidized seed. Such interventions can disrupt markets and hinder the emergence of sustainable commercial seed enterprises (Rohrbach et al. 2005).

Though most farmers still obtain planting material from their own farm or from neighboring farmers, markets for quality seed have grown in recent years, for example for sweetpotato in Uganda and Tanzania (Kikulwe et al. 2020; Mwiti et al. 2020). Because informal seed exchange and seed aid are dominant, there is rarely a clearly defined market price for planting material, a challenge for would-be entrepreneurs and the development of the seed sector. To understand how people value new goods not currently bought in the marketplace, willingness to pay studies (also called value elicitation methods) can be used. The results of such studies can inform pricing policies and define potential demand for these goods. In this way policymakers and business managers can evaluate if the perceived benefits from a proposed product outweigh the costs of producing and providing it (Lusk and Shogren 2007). Willingness to pay studies are also used to define the (monetary) added value consumers perceive for a specific product vis-à-vis 'competitive' or 'comparable' products (Breidert et al. 2006), e.g. the premium price farmers are willing to pay for improved seed traits compared to currently available planting material.

Willingness to pay studies can be distinguished according to the method of data collection. The first broad division in methodology is between *revealed* preference (non-hypothetical) and s*tated* preference (hypothetical). Revealed preference studies use existing market data to derive implicit values of a good, so they are most useful when the good already exists, albeit indirectly, in the market. The benefit is that in this way real choices are examined. A downside is that valuation is indirect and must be inferred from empirical patterns.

With stated preference methods, respondents are requested, directly or indirectly, to state their value for a good or service. These methods allow researchers to create a controlled, hypothetical market including multiple scenarios. Stated preference methods also have several downsides; for example, the respondent may be aware that the market situation is hypothetical, or the context may differ from real-life decision-making contexts (Lusk and Shogren 2007). In addition, stated preference focuses on an individual's behavior in

hypothetical choice/valuation settings, which may not correspond well with individual behavior when real money is used.

According to Lusk and Shogren (2007), experimental auctions combine the advantages of both revealed and stated preference methods. The benefit of experimental auctions over other stated preference methods is that they have actual economic consequences. This decreases the likelihood of overstating (or strategically understating) willingness to pay. In general, experimental auctions have advantages over other revealed and stated preferences methods. There are a number of experimental auctions, such as English auctions, Dutch auctions, and sealed bid auctions. Sealed bid auctions can be further classified based on the method of soliciting bids and identifying the purchasing price: first-price auctions, second-price auctions (also known as Vickrey auctions), random nth price auctions, and Becker, DeGroot and Marschak (BDM) auctions (Figure 1).

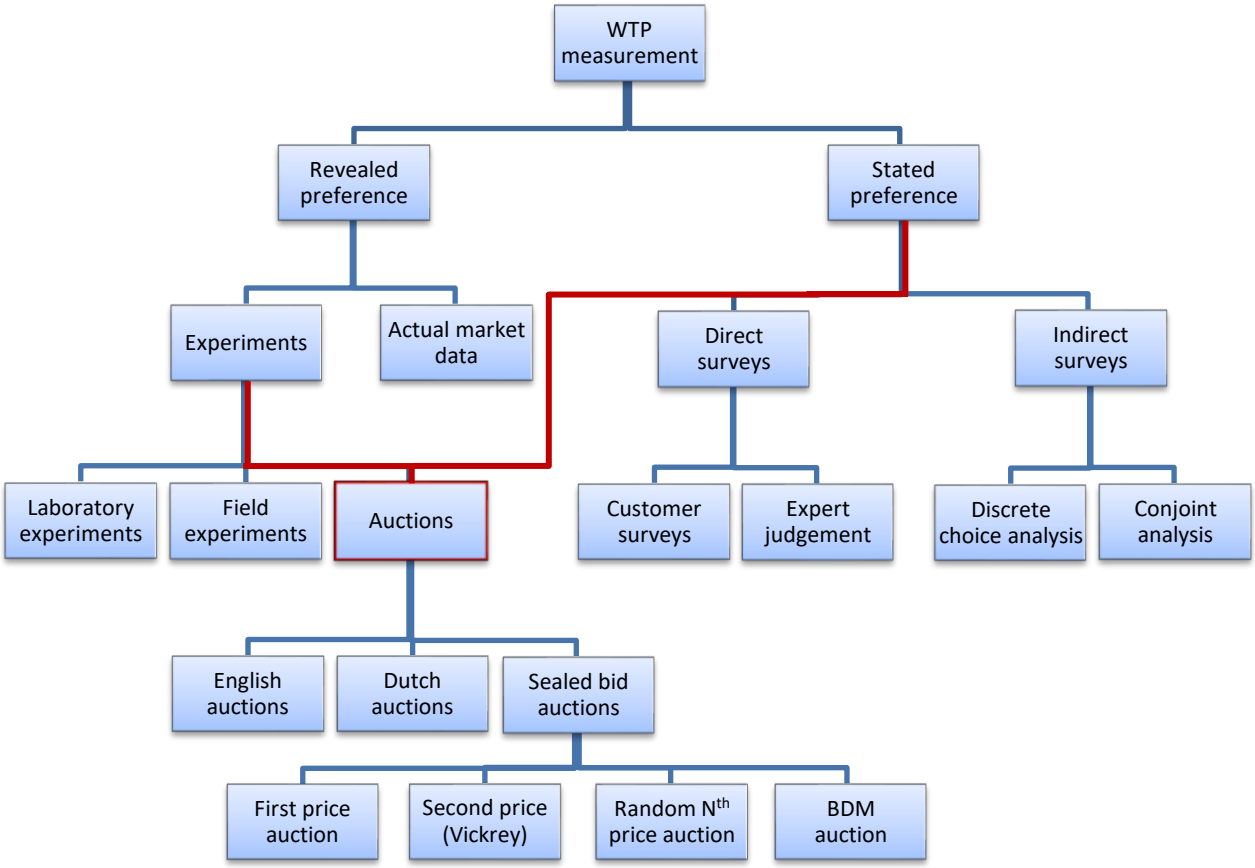

Figure 1. Classification of Willingness to Pay methods. Adapted from Breidert et al. (2006). The red line indicates the relationship of the approach described here, where experimental auction data is paired with direct survey data from participants.

The bids placed at experimental auctions are useful to produce demand curves, the market share of the product, to determine relative WTP and to help identify determinants of WTP. There are also studies in which auctions are used to measure the reverse concept - willingness to accept a product (WTA). WTP studies measure the maximum amount of money a person will pay that makes them indifferent to the improvement of quality of the good. In other words: how much extra money is the new product worth to you? WTA, in contrast, is used to measure the maximum amount of money a person will *accept* for a difference. WTA is therefore normally used in measuring compensation value for degrading the quality of an existing product. In

our case, where we want to measure the additional value placed on quality planting materials, WTP is usually more appropriate.

OBJECTIVE

As illustrated in Figure 2, there are many ways to conduct an experimental auction. Providing an exhaustive manual is challenging due to the many possible combinations; see for example the 300-page attempt by Lusk and Shogren (2007). The objective of this manual is to provide an overview of common types of experimental auctions, to describe the general steps involved in conducting seed auctions, to share experiences and insights from applying auctions in the context of vegetative propagated crops for smallholder farmers, and to provide a list of useful literature for further reading.

2. MAJOR TYPES OF EXPERIMENTAL AUCTIONS

Experimental auctions can be thought of as a family of closely related methods. There have been many types of auctions over the years with different methods and purposes. Here are some of the most popular:

English auctions
English auctions are likely the most well-known type of auction. At English auctions bidders openly place bids against each other in an attempt to purchase a good or service. The price increases with each bid, and the product or service is sold to the highest bidder. English auctions involve an emotional component, and are suitable in situations where the motivation is maximizing the profits of the auctioneer (and the seller). In this competitive environment, bidders might act on an emotional desire to win, and risk overvaluing the product.

Dutch auctions
At Dutch auctions, similarly as at English auctions, bids are public. In contrast to English auctions, the price of the good or service starts high, and is gradually decreased. The auctioneer begins the auction with a (often unrealistically) high bidding price, and lowers it until one of the bidders accepts the price, or when a predetermined reservation price is reached. Like English auctions, this arrangement also fosters a competitive environment intended to maximize auction profits. It also protects the seller of the product from unacceptably low-price outcomes.

Sealed bid auctions
At sealed bid auctions, bidders submit their bids for the auctioned good or service simultaneously and privately. In sealed bid, first price auctions, the good or service is sold to the bidder who placed the highest bid. In sealed bid, second price auctions, also referred to as Vickrey auctions, the bidder who placed the highest bid wins the auction, but pays only the price of the second highest bid. This incentivizes participants to reveal their true bids, because what people say is separated from what they pay. This structure also generates a single winner in each auction. In a random *n*th auction, the winning bid is selected randomly, and all participants with bids higher than the *n*th price can purchase the product at the randomly-drawn *n*th price. This can increase the engagement of off-margin bidders (Shogren et al. 2007), but requires that the auctioneer(s) are ready for the potential of a high number of purchasers.

Becker, DeGroot and Marschak (BDM) auctions
While previous auctions are conducted in groups, BDM auctions measure willingness to pay individually (Becker et al. 1964). Bidders do not bid against each other, but state their value in a single bid. Like in the *n*th price auction, a price is then drawn (from within a realistic range) to determine the threshold for winning bids, although since there is only one participant this time the winning bid is drawn from a given distribution determined ahead of time by the researcher based on available data or market research. If the placed bid is lower or equal to the price drawn from the distribution, the product or service is not sold. If the placed bid is higher than the price drawn, the product or service is sold for the value of their bid (Bull et al. 2019). This

requires preparatory research by the researchers to calibrate the price. BDM auctions could be particularly useful in rural setting with dispersed populations where organizing groups may be challenging and demanding, especially if there is an interest in engaging with participants of specific characteristics (stratified sample).

Figure 2. Participants listen to the auctioneer describing the differences between sweetpotato seed in Rwanda (CIP).

GENERAL STRUCTURE OF AN AUCTION

The first step of the research method is to develop a conceptual design in which the objective and appropriate treatments (i.e. variety, quality, or nutrition aspects) to address this objective are defined. When the objective and treatment are clear, the most suitable auction type can be selected. In general, a strength of experimental auctions is their flexibility in design. Still, there are some core elements that are present in all auctions. For example, there must be an auctioned good or service, there is an auctioneer that leads the auctions, and bids are placed by the participants which are used to define the value of the good or service. It is necessary to have an auction script for the auctioneer to describe the auctions and explain the rules.

The number of auctions and participants should be determined via power analysis to determine the minimum sample size, according to factors such as the number of treatments that researchers wish to test, the number of products, etc. Sample size calculations are important to ensure that the sample size is large enough to ensure statistically significant results. Sample size calculations may also ensure that resources are not wasted by taking samples that are much larger than needed to detect a difference. For further discussion, see Canavari et al. (2018).

Participant selection is an important stage in which researchers must decide who is their target population of interest, and how to select participants from this pool in either a random or purposeful way. This stage is important to avoid selection bias, and to set up any population treatment groups the experimenter desires. Participants can be sampled from voter or census registrations, randomly at village level, and based on group membership (e.g. participants must be farmers). Determine relevant differences in populations before starting the sampling. When, for example, there are considerable differences in markets between two regions, combining the results of those regions will make the results less valid.

Practice or training rounds are common in experimental auctions, to allow the participants to learn the rules ahead of the consequential bidding rounds. These are usually conducted with separate products, independent

of those to be auctioned, in order to avoid influencing experimental results (for example the practice round can auction off familiar snacks or small household items, not seed). The results of practice rounds can be useful data in their own right for detecting methodological problems or biases (Briz et al., 2017).

Another controversial issue in group auctions has been whether or not to post the bidding results publicly between rounds. Although there may be some value to price feedback (e.g. Corrigan et al. 2012), it has become common not to post the results, which can influence bidding behavior (Canavari et al. 2019).

EXAMPLE RESEARCH QUESTIONS

- What is the premium price farmers are willing to pay for quality seed?
- What is the premium price farmers are willing to pay if the quality of seed is guaranteed/certified by different actors?
- What is the premium price farmers are willing to pay for improved versus local seed?
- What are the drivers of the demand for quality seed?
- Is there a market demand for a newly developed agricultural innovation?
- What socioeconomic characteristics influence willingness to pay for a certain good or service?
- Are there gender differences in willingness to pay for a certain product? How can any gender differences be explained, e.g. attributed to differences in resources, control over resources, aspirations, educations and technical knowledge, networks and trust, among others?
- Does providing information increase willingness to pay for a certain good or service?
- Are farmers willing to pay a premium for the high beta carotene nutritious biofortified varieties as opposed to the non-biofortified local ones?
- How much of a subsidy is needed to generate a level of adoption that will have an impact based on the epidemiology of plant diseases?

3. LESSONS FROM THE FIELD

For auctioning vegetative seed in a developing country context

Before getting started with planning your own auction, it is useful to learn from some previous experiences conducting auction work in the field. This can help to stimulate your thinking about your own context, and to prepare for some of the unplanned issues you may encounter. Before conducting your seed auction, you should consider the following.

a) Deciding on the auctioned products

Many types of vegetative seed are perishable and bulky. For example, to auction sweetpotato vines, a fresh supply is needed at least every day. In cassava, typical spacing requires 10,000 cuttings per hectare, which can mean many tons of planting stems are required for a single farm. Transporting samples to the auction location can thus be challenging. One solution is to auction small samples, such as a single bundle of cuttings. However, a given unit size may not be attractive to particular types of farmers, depending on farm size, their motivation to buy the seed (testing small amounts vs. planting a whole field), and other factors. A small unit may not be of use to larger-scale producers, while the cost of a large unit may exclude smaller producers. Deciding on the sample size of the auctioned material thus requires careful thought, and depends on the research questions being asked, as well as on local norms and expectations for planting material packaging.

b) Seasonal timing of experimental auctions

Auctions are commonly used in agricultural research, but usually involving consumers of food products such as biofortified rice (Lusk and Hudson 2004). Rice is consumed year-round, hence the timing of the auction is not very important, unlike seed, as most crops have specific planting seasons.

Auctioning seed off season may lead to poor results. Conversely, in some crops people are used to purchasing planting materials immediately following harvest and storing them safely at home. Plan the auction dates carefully, taking into demand peak buying season for the crop. Intra-season factors can also greatly affect market prices, e.g. if it is late in the planting season or if disasters like drought force farmers to replant, driving up seed prices higher than most households can afford.

c) Time of the day

In addition to seasonality, time of day is also important. Morawetz et al. (2011) found a significant effect on willingness to pay for maize flour depending on the time of day the auction was held. Changes in bids throughout the day can have multiple causes. It is for example possible that valuation of a good differs in time depending on hunger, fatigue, schedule, habit, or biological factors such as hormonal regulation. Participants who are hungry might value a food item more highly (Hoffman et al. 1993; Rutsaert et al. 2009). The opposite can happen if the good is non-food or not ready to eat: farmers might prefer to keep their money to buy a snack after the auction. Another explanation might be the relationship between the metabolic state of a hungry or tired participant and decision-making under risk (Symmonds et al. 2010). Try to maintain consistency in auction timing to avoid biasing results. The time of day is critical to ensure that all groups of farmers are able to participate. Gender norms about women's mobility and their higher responsibilities in the household may limit their ability to take part in the auctions, thus leaving out most of the farmers. In some contexts, women may not be able to join meetings that are held late in the afternoon, when they have to prepare dinner and care for children (Meinzen-Dick and Zwarteveen 1998). Conversely, auctions held early in the morning during periods of peak field labor demand may limit the participation of young men, who may be at work, harvesting the crop.

d) Environment

The location of the auction is also important. Auctions should be conducted where participants can easily attend, but you should also consider your research requirements. For example, is there enough space to separate participants enough to avoid collusion? Do participants need a place to sit and write? Is the location likely to attract a large group of spectators, distracting participants from the auctioneer? Are there enough members of your target population nearby to easily assemble the required number of participants, and since auctions are quite sensitive to participant number, is there a plan B if insufficient participants arrive? Could sociocultural norms (e.g., limiting women's interaction with men, active participation in mixed-sex groups, and mobility) prevent women from effectively participating in the auctions? Is the location accessible and acceptable to all farmers including women, ethnic minorities, and other marginal groups? Women may not be able to attend meetings in places that are not considered culturally appropriate (e.g., pubs, certain religious buildings, etc.) or are too far from home, interfering with their domestic and child care responsibilities (Meinzen-Dick and Zwarteveen 1998).

e) Payment and endowment

During auctions, smallholder farmers are often given a little money to place bids. However, these gifts may affect willingness to pay, as the money is a windfall which can create an 'income effect', so the windfall money is spent differently than the participant's own earnings (Kahneman et al., 1991). In fact, the results are mixed across different types of auctions (e.g. Lusk et al. 2004). Psychological phenomena such as loss-aversion have also been implicated, in which potential losses carry more influence on decision-making than gains of an equivalent amount (Kahneman et al., 1991). When farmers bid with their own money, these influences may be reduced. However, the effects of payment type should be closely considered or tested for feasibility and complications. For example, it might not be appropriate or ethical for an NGO conducting auctions to request farmers to bring their own money, depending on what the experimental treatments are. Requesting people to bring their

own money can also result in self-selection, biasing the study towards those with more cash (Kilwinger et al., in prep).

f) Experimenter effect

Auctioneers have a key role in experimental auctions, presenting the products or services and providing the required information about them; thus, they apply the experimental 'treatment'. The way this is done can modify the results by consciously or subconsciously influencing bids (e.g. Morawetz et al. 2011). To avoid experimenter bias, it is first of all important to provide thorough training to the auctioneer and other enumerators. Where possible it can be beneficial to have a single auctioneer run all of the auctions. When time or budgets do not permit this, the data should at least be tested for an experimenter effect by using auctioneer ID as a dummy variable. The researchers should also consider who else will be present (e.g. village head, province or district authority, foreign researchers) and the potential effect of their presence on participant behavior.

g) Literacy

The general auction structure can be implemented with nearly any population of seed-using people. However, rural literacy levels vary widely (both of reading/writing and of mathematics). Depending on the case this could mean limiting the use of written instructions, providing extra support for writing down bids, and making sure to use standard local measures to avoid the necessity of a lot of mental math for participants to arrive at quantities that are meaningful for them. As a rule, make your approach as accessible as possible, provide support where it may be needed, and remain aware of participant sensitivities that may limit asking for help.

h) Cultural considerations

In the field, the wide range of cultural diversity, practices, and understanding can also be challenging. For example, some researchers have suggested that underbidding in Vickrey auctions may be related to the opposing forces of altruism and spite (Flynn et al. 2016). See Harrison and List (2004) on the complications of field experiments. Field research always brings fresh challenges. In Southern Laos, auctioneers encountered increased use of a traditional drug (areca nut or 'betel nut') among certain ethnic and social groups during auctions conducted on auspicious days (Erik Delaquis, unpublished data). The use of stimulants such as areca nut/paan (South and Southeast Asia), coca leaf (Peru and Bolivia), kola nut (West Africa), or qat (Ethiopia) are common during communal gatherings in many cultures. Research on the effects of providing food was discussed briefly above; what effects traditional intoxicants or narcotics (and more common substances like caffeine, nicotine, or alcohol) have on bidding behavior are not understood. This further illustrates that researchers should be aware and vigilant in documenting unexpected elements encountered in the field.

Figure 3. An auction for cassava stems taking place in a Buddhist temple in Southern Lao P.D.R. (Alliance of Bioversity International and CIAT / E. Delaquis).

4. GET STARTED

I. DEVELOPING THE STUDY DESIGN

Any research must have a proper study design, with clear objectives and research questions. Based on this research design, decisions can be made on the most suitable way to apply the method.

a. Select the auctioned product.

As mentioned in the lessons learned section, the selection of the products to be auctioned requires careful consideration. When auctions are used to determine the difference in willingness to pay between two or more products it is important to consider all the differences between the products. If, for example, the auction is used to define the difference between WTP for biofortified orange-fleshed sweet potato and non-biofortified sweetpotato, the other characteristics of the varieties should be as similar as possible. If for example the biofortified and non-biofortified varieties also differ in maturity time, yield, disease resistance, etc. it is hard to define which of these characteristics attracted the higher bids. As mentioned above, it is also important to think through the size of the seed samples (depending on bulkiness and quantities available), where and how often to obtain fresh material (depending on perishability and storability). Vegetative planting materials are seldom as uniform or even as grain seed, so special efforts should be undertaken to ensure uniformity of the seed at auctions.

b. Decide on an elicitation mechanism.

The auction type can be selected depending on the research context, research questions, and the material to be auctioned. A literature review can help in making this decision. Also consider your budget and other resources. The costs, labor, and time required to conduct different auction types is variable. Section 2 discussed some of the common types of auctions and their characteristics. Now is the time to consider this more carefully. What are the goals of your research? To find out the maximum willingness to pay? Or maybe to understand the perceived additional value of a given trait from an individual setting? This depends on your research. Think carefully about your goals and revisit the pros and cons of each elicitation method. There is no right answer, but there are probably particular methods that better suit your research questions, context, and available resources. One major consideration is if you are able to convene groups of farmers, or can only manage individuals, in which case methods like the BDM are likely more appropriate.

c. Develop materials such as auction scripts and bidding sheets.

When the products to be auctioned and the auction type are selected, a more detailed study design can be made. The number of bidding rounds can be decided on, an auction script can be developed, and bidding sheets can be designed. A common recommendation in the literature is to make sure that auction scripts are consistent across all sessions. How plausible will this be in your scenario given differences in culture, education, or language? How can you adapt to the foreseen challenges? Bidding sheets should be clearly designed to avoid confusion in the field, but should also leave the auctioneers with enough flexibility to adapt to local conditions.

d. Develop a sampling design.

The auction should be conducted among a representative group of farmers. As in all studies, the most suitable sampling design depends on the research question. It is important to consider a power calculation prior to the data collection to define the minimum required number of respondents to allow for statistical analysis based on the number of treatments. The formula to calculate the minimum sample size needed per treatment to detect differences in WTP between two treatments is the following:

$$n = \frac{2\left(z_{1-\alpha/2+}z_{1-\beta}\right)^2(1+(M-1)\rho)}{M\left(\frac{\mu_0-\mu_1}{\sigma}\right)^2}$$

Where μ0 and μ1 are the mean value from two different treatments, σ is the common variance, M is the number of repeated measurements (i.e., auction rounds), ρ is the correlation between observations. Following standard assumptions in the literature, α, which is the incorrect rejection of a true null hypothesis (type I error), is often set at 0.05. β, which is the failure to reject a false null hypothesis (type II error), is commonly set at 0.20. The values of μ0, μ1, σ and ρ need to be determined from primary and secondary data collected prior to the start of the auctions; this can be done in a number of ways including the use of data from previous studies or published literature, a pre-auction survey, or other means of obtaining estimates.

e. Make a data analysis plan.

Make a data analysis plan prior to data collection. For example, the intended econometric model can already be designed based on literature and other information sources. This can help define the other information that needs to be collected from respondents, for example, the type of socioeconomic or agroecological data that is relevant to answer the research question. This type of data is usually collected via a survey before or after the actual auction, to avoid mismatching or incomplete data.

f. Considering gender.

Considering gender is relevant in a willingness to pay studies. Access and control over resources (including land, labor and money), access to information and technical knowledge, aspirations and perceptions about problems and solutions can differ within and among households. Women face disadvantages in accessing information and training as extension services are often biased towards men (Mudege et al. 2016). Women also tend to have lower access and decision-making over resources such as land, labor, and cash than men, and these gaps are linked to significant gender gaps in the adoption of new technologies (Doss and Morris 2001; Peterman et al. 2010; Ragasa 2012) and in agricultural productivity (Kilic et al. 2015; Goldstein & Udry, 2008; Peterman et al. 2014). Trust in institutions may also differ between men and women leading to differential preferences for innovations (Akter et al. 2016). Women tend to make higher bids in auctions than men, although this is not universal (Canavari et al. 2019). A proper research design can allow researchers to identify these differences. You should also think through the actual auction setting in the specific context.

Willingness to pay is likely to be influenced by the characteristics of farms and farmers, their perceptions about the problems and solution, the innovation itself and institutional and policy factors. Gender is important in all of them. These factors may be correlated with gender, creating challenges in disentangling them from gender. Higher willingness to pay for clean seed could be explained by wealth, access to land or labor, attitudes about risk and aspirations for the future, market orientation as well as access to information from trusted resources. Women and other marginal farmers such as those from ethnic minorities are likely to differ in all of these characteristics. In Kenya, (Kaguongo et al. 2014) find that women are likely to pay more for certified seed potatoes than men because they are also more likely to participate in training programs regarding the importance of high-quality seed. Therefore, it is critical to collect sex-disaggregated information to control for women's and men's different access to resources, information, knowledge, roles in agriculture and other factors that may be correlated with willingness to pay. This information could be collected through carefully designed individual surveys.

Participants in auctions should be selected from among the household members who are actually involved in producing the particular crop and have input in the decisions about it. If men and women make crop decisions jointly, it could be advantageous to invite both husbands and wives to take part in the auctions. Auctions with husbands and wives can help reveal not only the willingness to pay for an innovation, but also intra-household dynamics and how decisions about agriculture are made (see Gulati 2016 for an example). This approach may provide great insights for the targeting of interventions in seed systems such as who in the households to target for the intervention.

Figure 4. An enumerator holds the bid recording sheet while the highest bidder receives her sweetpotato vines in Rwanda (CIP).

II. DATA COLLECTION AND MANAGEMENT

In addition to the planning considerations mentioned above, data collection and management require attention in order to go smoothly. Some considerations include: will all bids be recorded directly on a master sheet, or will each participant have a paper and pen for writing down their own bids? If the latter, how likely are the participants to be able to read and write? In what language(s)? Will there be enough enumerators to assist the participants with data collection in a timely fashion? The checklist below provides some useful tips.

- ✓ Enumerators should have the required skills and be able to communicate well in the local language with selected respondents.
- ✓ Detailed and in-depth training and practice for enumerators is essential. Don't let your valuable data collection session be trial runs!
- ✓ Pre-test tools such as questionnaires and experimental set-up in the field. Supplemental questionnaire types can be broken up into steps i.e., i) key informant interviews, ii) pre-pilot, and iii) pilot survey. Make sure that questionnaires are well-tested and there is no confusion about questions and how to record answers.
- ✓ Data can be collected on paper or digitally. It advisable to check the output generated by digital data collection devices and debug thoroughly before going forward with collection. If it doesn't work flawlessly during practice, it will never work in the field.
- ✓ It is recommended to assign an enumerator to check either paper-based or digital surveys while in the field. Corrections are easier to make if done immediately.
- ✓ It is good practice to collect phone numbers of all participants in case issues are later found with the data, although cellular use and coverage are still far from complete in most developing countries.
- ✓ Design a pre- and/or post-auction questionnaire. Some socioeconomic or agronomic data can best be collected before the auction starts, for example questions about the knowledge level of the respondent on the auctioned good. This is especially relevant when product information is provided during the auction. Depending on the research questions, not all data is appropriate to collect before the auction starts, for example in cases where it can give respondents a hint towards the study

objective. This can lead to participants showing ideal versus real behavior. Questions that are expected to influence bidding behavior can hence better be asked after the auction.

- ✓ Time the implementation of the survey and auction. Most farmers are busy people and don't have time to waste – respect their time and implement a lean, well-considered auction. Don't add content that doesn't contribute to your analysis or you risk frustrating your participants and getting poor-quality responses.
- ✓ Ask farmers for their consent to participate in the study before you start collecting data.
- ✓ Practice, practice, practice.

Figure 5. Auction enumerators administering the pre-auction survey and handing out paper slips for writing down silent bids in Lao P.D.R. (Alliance of Bioversity International and CIAT / E. Delaquis).

III. ANALYZING THE DATA

Important insights about the results of the auctions can be gleaned from the basic statistics, which can provide a direct estimate of the monetary value of the product(s) of interest, and the differences between them. These can be used to create demand curves, and to estimate the market shares and elasticities for specific products.

Auctions can include an experimental design with some participants randomly assigned into control and treatment groups. For example, the residents of village A, which has not been exposed to a particular seed product, and village B, which already has experience with the product. The treatment group could alternatively be asked to bid on a different product, or given different information about the products, etc. In that case too, the main hypothesis would be tested by comparing the difference in means (and other moments) of the bid distribution between the treatment and the control groups.

For most purposes, however, additional econometric analyses are needed to get the full value from the data. Econometric analyses help to address certain features of auction data, and to test different hypotheses, including how bids may vary depending on the socioeconomic characteristics of the participants, or the

characteristics of the auction itself (for example, who was the auctioneer, and did their style change bidding behavior?).

Here we highlight a few key features of the data that need to be considered. More guidance is available in Lusk and Shogren (2007). First, auction data usually includes multiple observations from each participant. One participant usually submits multiple bids by bidding for the same product in multiple rounds, or by bidding for multiple products in one or more rounds. In cases with more than one observation per participant, it is important to account for the lack of independence of the errors, and to include an individual specific error term in the regression model. Fixed or random effects are commonly used to deal with multiple observations per person. The advantage of a random effects model is that it allows for the estimation of coefficients of variables that do not change between rounds (e.g. gender).

Second, auction data could be censored either from below or above. Usually, participants cannot bid less than zero, implying that bids are censored at zero (i.e. negative bids are not allowed – this is typical of WTP studies, as opposed to WTA). Bids could also be censored from the right/above if participants are unwilling to bid more than an established market price for a product, even though their valuations of the product may be higher. The Tobit model is commonly used with censored data, and can be combined with fixed or random effects. See McDonald and Moffitt (1980) for more information on the Tobit model. See also Drichoutis et al. (2017) and Zhou et al. (2017) for applications with auction data. However, here also some caution is in order. Tobit results will diverge from ordinary least squares regression results when the share of observations that are censored is non-negligible. When a small share of bids are zero (e.g. 5% of bids), a Tobit model and an OLS model are expected to yield very similar results, so using an OLS model could be a simpler approach.

In terms of modeling, willingness to pay for different products is usually presented formulaically as:

$$b_{i,j} = \alpha + \beta P_j + \gamma \mathrm{T} + \delta X_i + \mu_i + \varepsilon_{i,j} \qquad for\ all\ i\ and\ j,$$

Where $b_{i,j}$ is the bid of participant i for product j; α is constant, and β is the vector of coefficients for the characteristics of the product (e.g. quality declared seed, certified seed, etc). The interest of most studies is focused on β, which captures the differences in WTP for the different products.

For auctions with an overlaid experimental design, γ captures the vector of coefficients for the variables that characterize the experiment. Some studies may be more interested in how the experimental design influences bids for the same products. For example Maredia et al. (2019) study farmers' willingness to pay for three seeds of three different qualities – farmer seed, quality declared seed and certified seed. Their key interest was on whether the differences in WTP for the different seed types differed depending on their perceived performance from field observations. Additional terms include μ_i as the individual specific error, and $\varepsilon_{i,j}$ as the idiosyncratic error term.

Besides being necessitated by the features of auction data, another motivation for the use of regression analyses is to understand what factors may contribute to individual differences in WTP. Most auction experiments are paired with a survey or other method for gathering socioeconomic data of the participants. High average bids may obscure significant farmer heterogeneity in WTP. Groups like large-scale farmers or male farmers may have higher willingness to pay for certified seeds because of higher access to complementary resources (like money or labor) and higher expected returns (Suri 2011).

5. CONCLUSIONS

The analysis of farmer demand for different types and qualities of seed is an important step in developing sustainable seed system interventions, including organized group actions, sustainable business models, and public-private partnerships. A successful seed intervention also requires an understanding of the cost of supplying seed of different qualities and standards, and the epidemiology of pests and diseases that may lead

to seed degeneration over time. An understanding of farmer demand at the outset of a seed system intervention can help prioritize technology development and investments that ensure the production and market price of seed are well in line with farmer demand in a given context.

Experimental auctions are useful research tools to assess local demand for seed. There are several methodological options. The most suitable method depends on the study objective, hypothesis, treatments, context, budgets, etc. Because of this broad methodological variability, a thorough literature study will help researchers to make informed decisions and increase the validity of their results. An auction to understand smallholders' seed demands should take into account timing, farmers' motivations to buy seed, whether to give participants cash or not, the size of the venue, using the same auctioneer, and other important contextual aspects. This brief guide can assist researchers in their study design and to guide them further towards useful literature.

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