

The University of Arizona College of Agriculture and
the Arizona Historical Society Oral History Programs

Narrator: Leon Moore

Interviewer: George W. Ware

Transcriber: Beth Thrall

April 15, 1994

Department of Entomology

Cooperative Extension Service

Today is Friday, April 15, 1994. My name is George Ware representing the University of Arizona College of Agriculture. Today I am in the company of Leon Moore for the purpose of recording Leon's recollections of Entomology, Insect Pest Management and Integrated Pest Management in the State of Arizona. We are in Leon Moore's home at 4469 North Camino Gacela, Tucson, Arizona, 85718.

Ware: Leon, am I correct in stating that it is your intention to give this tape and the typed manuscript resulting from this interview to the Arizona Historical Society?

Moore: That is correct.

Ware: Well, that's good because this becomes a legal statement and it permits us to carry it on and use it for historical records in years to come. Leon, you have just retired about a year ago from the University of Arizona, College of Agriculture, Extension Service. I would like for you if you will to go back to the very early years of your life and tell us a little bit about your background.

Moore: I was born in the Western part of Arkansas near the Oklahoma border in 1931 and I grew up on a small farm in that area. My parents actually grew cotton and some other row crops and did some raising of cattle so that was basically what we did during the early years of my life. We gradually moved East from where I was born and ended up in the little town of Waldron, Arkansas. That's where I spent most of my young life growing up

and I got my education through the 12th grade there. From there, I graduated in 1949 and moved on to college first at Arkansas Tech. Basically that's the beginning part of my life.

Ware: Who were your parents?

Moore: Fred Lee Moore was my Dad and he was born in the Oklahoma Territory in 1894 and he migrated, of course, over into Arkansas. My Mother was Lenya Mae Tamplin was her maiden name. She was born in Texas. My father and my mother were both married at a relatively young age and started families, then their mates both died. About a year before I was born they met and were married and they had what essentially is the family that is mine. Actually we had three families melded together. I had four sisters and a brother. The brother died when he was three years old. But that then is my immediate family and the four sisters are still alive and all still live back in the Arkansas area. My parents lived until 1983 and strangely enough died within about three months of each other in that year. They are buried near Waldron, Arkansas.

Ware: You have no brothers?

Moore: No, none that are alive. The one that died was only three years old when he died of pneumonia. At that time there was apparently no readily available cure for pneumonia and so he died from that when he was three years old.

Ware: Tell me about your college education.

Moore: To start with when I left high school I went to Arkansas Tech and that was in 1949. Arkansas Tech is located over at Russellville, Arkansas, a small two-year school at that time. It is now a four-year university. The fact is that I started to school there in 1949 in

what was referred to as General Agriculture. The intent was to get a couple of years of study there and then be able to transfer on up to the University of Arkansas to complete the education. Unfortunately, while I was there, in 1950 the Korean War became a problem so my education was interrupted in 1951 when I joined the Air Force in January of 1951 to avoid being drafted. I spent four years in the Air Force during the Korean War and came back and went one semester in 1955 at Arkansas Tech to sort of tie up loose ends there. I then transferred to the University of Arkansas the Fall of 1955. I completed my B.S. degree in General Agriculture at the University of Arkansas at Fayetteville in 1957 and immediately went on to begin work on my Masters degree in Entomology because while I was studying there toward the end of my Bachelors degree, I took a course in Entomology and I decided that that was something I really liked. That started my interest in Entomology and I decided to pursue it to an advanced degree. Thanks to my GI Bill of Rights, I was able to go on and complete my Masters degree at the University of Arkansas.

Ware: When was the Masters degree?

Moore: That was January of 1959. At that time I decided rather than going to study for the Ph.D. immediately, that I would go to work for a while. That's when I started looking into jobs and my major professor there had a call from Dr. Larry Carruth, who was Head of the Entomology Department here at the University of Arizona, and he was looking for a person to be a Survey Entomologist in Arizona, so to make a long story short, I guess that's how I originally came to Arizona. It was because that Survey Entomologist position was

available. After I worked here for a while, I was eligible for a sabbatical leave and I worked out an agreement with Kansas State University to do my research project in absentia here and then went back there for a year for my sabbatical leave and finished out the course work that I needed for my Ph.D. and that was then 1972. So to bring it all into a nutshell, I started my education at Arkansas Tech University of Russellville, Arkansas; transferred to University of Arkansas where I received my B.S. degree in 1957; my M.S. degree in Entomology in 1959; then received my Ph.D. from Kansas State University in 1972. So that is my educational background.

Ware: Slow but sure. Okay, now let's go back and tell us about your marriage and your family that resulted from the marriage.

Moore: Okay. When I went to Arkansas Tech in 1949, and actually it was the following year that June Morris came there to go to school from Hartman, Arkansas. June and I met there at Arkansas Tech and we dated and everything for the rest of that year, I suppose you'd call it, until 1951 came and I had to leave for the military service. When I completed my basic training and had gone for additional training at _____ Air Force Base in Mississippi, on my way back through to go to my permanent station at Hamilton Air Force Base in California, June and I were married. That was in July of 1951 and we were married in Little Rock, Arkansas. After I had gone on over to Hamilton Air Force Base and got settled in there, she joined me at Hamilton Field. We lived in Petaluma, California for a while. Out of our marriage has come four children and it started almost immediately. Stephen was born at Hamilton Air Force Base in July of 1952 and then a little over a year

later, August 6 of 1953 Daniel was born at Letterman Army Hospital just across the Golden Gate Bridge in San Francisco, California. Then David, our third son was born in Fayetteville, Arkansas in 1958, that was after we had gotten out of the military service and had returned to the University of Arkansas to study. Susan, our only daughter and the last of our children, was born here in Tucson, Arizona in 1965. We have the four children and they're all married and all live here in the Tucson area at this time.

Ware: Tell me a little bit, quickly, about your duties during your four years in the Air Force - your rank.

Moore: I was an enlisted man and went in as a Private and worked my way up to a Staff Sergeant. I was trained, actually was one of the early trainees in radar, which at that time was just being developed, so my duties were to work in radar surveillance and on the West coast of the United States we were responsible for detecting and investigating unknown aircraft that might be flying in toward the United States from the West or from the Northwest. Most of my duties then were to train others to deal with radar and to actually work in the radar detection system that we had there in the Air Defense Command. That essentially was what I did. I was never went to Korea although I was on orders several times, but always something happened that I didn't have to go, so all of my duty was there in California.

Ware: Were you one of the people that had to look at these scopes and watch the activity on the oscilloscope?

Moore: I worked actually in a controlled center and we had these scopes stationed out in different areas like on mountain tops and different places where people would watch the scopes and

they would pass the information in to us. Then we would make a decision as to whether we had to so-call scramble or send out a jet fighter to look at whatever it was that was on the screen that we couldn't identify. We would get an identification back from our pilot and we would make the determination then as to what it was and so forth. It was fortunate that nothing ever came there that we couldn't eventually identify.

Ware: Everything was a friendly force.

Moore: That's right.

Ware: That carries us through your education, your marriage, your military experience and then you alluded briefly to your coming to Arizona. Let's pick up on that because that's where we want to spend the rest of the interview as to your work here in Arizona. Your first job at Arizona was when and what?

Moore: I came here as Survey Entomologist in January of 1959. I came to Phoenix because what had happened was, they wanted a Survey Entomologist position but they wanted it to be a cooperative effort between the United States Department of Agriculture, the APHIS group, and the Arizona Commission of Agriculture and Horticulture, it was called at that time, and the University of Arizona. So it was a three-way cooperative effort to put a position into being that would examine or survey the State of Arizona, the major crop areas, for economic pest problem and to report that to a central group which was stationed in Washington, DC. They would then put out an economic insect report for the nation each week. That was essentially what that was. My responsibility was to cover the State of Arizona and to get that information in to them so that they could in turn report it as a

national effort. It was called the Cooperative Insect Report. That was a position which was very valuable to me and I still think it was very valuable because it gave me a strong basis of understanding of the insect problems in the State of Arizona and of the State itself. I had to be out in the State on a continuing basis working with the people, the Extension Service people, the farmers, and learning more about the crops and the insect problems that we had, so that was a very valuable time for me and it helped me to prepare for being an Extension Entomologist which became available to me in 1962.

Ware: Who was your immediate supervisor as Survey Entomologist?

Moore: The immediate supervisor was what we called the State Entomologist or the Head of the Commission of Agriculture and Horticulture and at that time it was Mr. Wick Mendenhall and he was my immediate supervisor. I worked with Dr. Jim Roney who, at that time, was an Extension Entomologist for the University of Arizona and coordinated my activities with him and with whomever was the leader of the APHIS group from USDA. So, we had occasional meetings, I can't remember how often, but we had meetings to coordinate the activities and to review my accomplishments and progress and to suggest or to develop programs for the future. So it was dealing with those three people. I did not have a single number one "boss".

Ware: Who was the third person? You said Wick Mendenhall, Jim Roney and who else?

Moore: Whomever was the head of USDA/APHIS. That tended to change quite often. Carl Rohwer was the first head of that group and would probably be the one that I served under most.

Ware: So you served as the Survey Entomologist for the State of Arizona from?

Moore: January, 1959 to June of 1962.

Ware: In that role, did you travel around the State?

Moore: Oh, yes. I traveled around the State all the time and so I just had somewhat of a regular schedule like going to Yuma County and on up in the Parker and Mohave Valley areas; then maybe the next week I would work my way over on the Eastern side of the State and visit the counties there like Graham, Greenlee and Cochise; and then the next week the in-between counties and sort of repeat this over and over again. But I also had to develop a system of contacts out there so that in the weeks when I didn't go to one of these areas, I could be on the phone asking people out there what they were seeing and what had occurred in terms of insect problems during the weeks when I wasn't there. It was a thing of coordinating and bringing about reports from cooperators as well as going out and detecting these problems myself.

Ware: Give me a sort of an idea of what a typical day would be, as a Survey Entomologist - what you would do.

Moore: In terms of going out and sampling, I would go directly to the farms and I would try to break down my time based on maybe the importance and the acreage of the crop and how intensive the insect problems were on it. So naturally in the summertime, I'd spend quite a bit of time on cotton, but I also saw and sampled several fields of cotton on any given day.

Ware: Sampling them for what?

Moore: For bugs - for insects. So I'd take just an ordinary sample of a number of fields around.
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Ware: How would you sample a field.

Moore: You actually go into it and use a sweep net and use visual observations of what was going on there in terms of bugs - I'd look at the terminals and look at the bolls - a number of bolls - and take an actual sample. Then I'd combine that with reports that I'd get from other people and come up with as much of a consensus as I could of what the pest situation was in that particular week. But I'd do the same thing for alfalfa, citrus, and all of the vegetable crops and any of the other crops that were growing in the State. It was my responsibility to cover the whole gamut and to try as much as possible to give an accurate picture of what was going on here in Arizona.

Ware: You spent most of your time though, surveying what particular crops?

Moore: Well, like I said, in the summertime it would primarily be cotton because cotton was so important and always had lots of problems. Now in the wintertime lettuce was very important because lettuce tends to have lots of pest problems, citrus would be important in the spring, especially. So it varied by time of year as to how much time that I'd spend on any given crop but try to be seasonal in terms of the intensity of sampling there based on what problems were occurring. In Arizona, cotton has always been the King of the Crops ever since I've been here for the last 30 or more years so naturally the interest from a national standpoint is what's going on in cotton in Arizona. Also you have to consider that's where most of the insecticide use occurs and has always occurred is in cotton. That

reflects the fact that there's where most of the bug problems were. Cotton, I would say, probably required about 80% of my time during I was Survey Entomologist and the other 20% would have been broken down into all of the other crops.

Ware: Briefly, what were the major pests when you were Survey Entomologist between 1959 and 1962?

Moore: Strangely enough, they were different than they would be today because at that time we had almost no activity from the pink bollworm although it did occur on occasion but there were efforts to eliminate it and it was really not a major pest until about 1965. So the major pests during the early times when I came here was like lygus bugs and cotton bollworm and possibly some of the things that we don't consider too much nowadays like the woolly-worm or the salt-marsh caterpillar and a few things like that. Those were the major pests in those early years.

Ware: Was the boll weevil a pest?

Moore: No, we did not have the boll weevil although on occasion we would pick up a boll weevil, but it was kind of like the pink bollworm, on occasion you would pick up one but nothing of any economic importance. Generally people felt - you often heard the statement that we will never have any trouble from the boll weevil or we won't have any trouble from the pink bollworm because - everybody had their own reasons. Some would say it's too hot here and others would say it's too dry here and various other things, but eventually these pests did become major problems. For a long time they were not problems and it seemed like every year we went by though the number of pest problems and the intensity of pest problems became a little bit worse. Instead of actually getting on top of things and doing

a good job of not bringing on additional pest problems, it seemed that the way we did things encouraged additional problems to occur.

Ware: When you say we, you mean growers?

Moore: Yes, people who were responsible for treating.

Ware: So the pests from 1959 through 1962 were really rather light and the jobs that you did - tell me a little about - let's just look at your life. You had to travel a lot alone, didn't you?

Moore: Yes.

Ware: And the vehicle that you used, was it air conditioned? Did you have to spend the night out? Tell us a little bit about your life away from home.

Moore: I certainly had to spend a lot of time on the road and I have to thank my wife for raising our family much of the time. I remember an interesting story of when we came here. We had a 1954 Chevrolet car and of course had no air conditioning in it when we came to Arizona and I was talking to a gentleman there in Phoenix who was in the Extension Service and he called me in to talk about this and he said, "Does your car have air conditioning in it?" and I said, "No, it does not." He said, "That's fine, don't put any air conditioning in that because the farmers will think we're too high-falutin' and they won't really want to deal with us in the way that we want to be able to communicate with them." Well, I took that to be gospel and made a couple of trips to Yuma and I steamed and steamed all the way, but then, the thing I was noticing though - you'd go out on these farms and you'd roll up beside a farmer and he'd roll down his glass to talk to you and I thought

something must be amiss here, so eventually I did get the air conditioning then put into my vehicle and that sure made life a lot easier once that happened.

Ware: You were driving your own vehicle?

Moore: Oh, yes. They paid you state mileage and that was generally true all through the years that the Extension Service paid mileage to me even after I became an Extension Entomologist and I drove my own vehicle. When we got on down a little later into the career and I did then start using more of the pool cars from the University.

Ware: Do you remember anything about the conditions of where you stayed in Arizona at that time? The cost of rooms? The names of some of the hotels or motels?

Moore: It was pretty cheap. I know we tried to get by as cheaply as possible and like in Yuma, there was a hotel called the Flamingo. It was up on the strip and it's not even - you can't even find where it was any more, I guess, but that was my favorite place to stay when I first came here and there were similar type places all over the State. I was thinking just the other day, that of all the places I used to stay, I don't believe any of them are still there and in use today. Those are the places when I first came here. There's been a lot of change in that regard, but I don't recall worrying about the rooms or the facilities or anything like that. I think my interests were more in getting a job done and I just stayed wherever was available and it seemed to me that all the places were well kept and that sort of thing, even in that day and time. I know I always worried a little about water in Yuma, I didn't like to drink the water there. It was about the same in Parker and a few places like that but you learned to work around that and find out where the good bottled water was, or whatever.

It was a hot job but my job's been that way throughout my career having to work in the summertime when the heat is so great and everything, it could be something that would discourage a lot of people but I really didn't let it bother me too much. I enjoyed it really. I'd work early in the day and generally complete most of

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Ware: You were talking about staying at different hotels and air conditioning and the like, and you quit at noon you said you could get most of your work done. Tell about the temperatures, what were the maximum temperatures you remember working in the fields, say even on rare occasions - how hot did it get in Yuma?

Moore: In and around 120 is about as hot as I've been out into the fields and actually they say you're stupid if you work in that kind of circumstances, so that's the reason for trying to work early. We'd go to work around 4:30 - 5:00 and by noon you're pretty well finished your day as far as the field is concerned. Then you get on back in because the hotter temperatures will come after lunch at 2 or 3 o'clock in the afternoon so we would make every effort to gear things to getting the field work done during the cooler time of day and then doing phone calling and visiting with people during the afternoons when it was hotter in the field. I do want to say this that during those early days like that, I recall seeing four-bale cotton quite a bit and five-bale cotton so some extent that had never had an insecticide treatment put on it in Yuma. So that's how much - well you can get an idea from that as to how much the insect problem has changed over the years. We couldn't dream of producing a cotton crop now and not having to treat it with a number of

insecticide applications. So instead of holding our own or getting a little better in terms of insect problems, they've actually over the years become worse. But that gets away a little bit from what we were talking about.

Ware: I want to give the reader an opportunity to know how you dressed under these conditions when the sun's beating down, there's not a cloud in the sky, and it may be as hot as about 120 degrees.

Moore: Strangely enough, George, you'd think you'd go as light as you could but I generally wore long-sleeved shirts. I did not wear short-sleeved shirts. I liked cotton because I always felt that it was cooler, or least a cotton blend. The lighter colors of course are better but I think loose-fitting clothing and something to cover most or all the body as much as possible to avoid the sun's effects. I always wore a hat to protect from the sun.

Ware: Was this a hat with a brim on it or a cap?

Moore: I tended to wear the baseball type caps and that of course is not the best, I'm sure, but I did wear a large segment of the time, especially when it was in the hotter time of the year, I'd wear a what I'd call a straw hat with a wide brim. That protected the ears and the back of the neck and so forth.

Ware: Well, you've had a lot of exposure to both direct and indirect ultra-violet from the sun, probably as much as just about anybody in this part of the world. Today we are looking at a major problem in older people and that is skin cancer that is caused by ultra-violet from the sun. Have you had any problems like that with your skin?

Moore: Not really. I've had spots removed from my forehead and the sides of my face and my arms but none of them have been the real cancerous type growth, so I've been lucky in that

regard, but I think possibly that the precautions I took in terms of keeping cover over those helped a lot. I didn't really start using any of the block or blockers, whatever you call them, until maybe the last ten years of my career but I'm sure those would have helped. But I guess I'm fortunate, I think people are different in their susceptibility to that disease. Fortunately, I haven't had any trouble yet but I have had those spots removed from my forehead and tops of my arms.

Ware: When you were in other counties away from home spending the night, what would you use for your office because I know you needed a place to make phone calls and do some of your paper work?

Moore: I used a combination of places. The hotel rooms is one place wherever you're staying, but the other is that I had a good relationship always with the County Extension people and also at the Experiment Station farms. I could go to any one of these places and find a place that I could call my office temporarily on any given day and work there during the afternoons. Combine that with visiting and if I wanted to just write I'd seek out an area there that I could sit down and have some privacy. The people - you know that's been one of the nicest things about working here has been the good people that I've had to work with over the years and the County Extension people and the Experiment Station people and everybody else have always been real good to help me. That, of course, goes for my years as an Extension Entomologist as well as when I was the Survey Entomologist.

Ware: It's a little hard I'm sure to separate exactly some of the circumstances of your employment but we have now covered the years from 1959 through 1962 as a Survey Entomologist. What happened in 1962 - did you change jobs?

Moore: I was working as Survey Entomologist and had a call from Dr. George Hull who was, at that time, the Director of Extension here at the University of Arizona and he told me that the University had been funded to establish a second Extension Entomologist position, one that would go along with the position held currently at that time by Dr. Jim Roney, and wanted to know if I would like to have that position. At that time we did not have to go through all of the things that you have to go through now in hiring people, and so he simply offered me that position based on the fact that I'd been working in the system and they all knew me and that I had a good deal of experience out in the State from my survey work. I accepted that position after thinking about it and discussing it with some people and then began the process of moving down here in May of 1962, so that was the process that occurred there. When I came here I remember that about the biggest thing that I was given was a key to an office and told that here's what needs to be done, now go develop a program for that and I was given certain responsibilities in terms of crops to cover for the insect problems and Dr. Roney was given the others to cover. We broke down the responsibilities that way and then we proceeded to develop Extension Service programs.

Ware: Exactly how were they broken down initially between you and Dr. Roney?

Moore: For a few years, I can't remember exactly the number of years, but for just a short time after I came here, my responsibilities were like the cereal and the forage crops and the home yard aspect of things - urban entomology so to speak, and the livestock and that sort of thing. Dr. Roney retained cotton as his primary responsibility and he had some of the other crops as well. But then after a short time, that was switched around and I was given

cotton as a primary responsibility and I recall that that was quite a change in my activities when that occurred. I had to switch from working on these other crops back more to cotton and since then I've served most of my time in cotton.

Ware: Jim Roney was the first Extension Entomologist in Arizona. He came here about 1943. You came here in 1959, so he had established himself as the Senior Entomologist. What was your relationship with him as a Survey Entomologist - how did you get along?

Moore: Got along very, very well. Dr. Roney was a person who was well-known out in the State, especially in the Phoenix area, and he was pleased to have a Survey Entomologist so he worked with me very closely and I was in his office several times per week discussing problems with him, discussing what I was finding out in the State and so forth and he contributed a lot in terms of what he found to what I was able to report in the weekly report, that was a very good relationship. I do think that at the time of my moving over to be an Extension Entomologist there was a little bit of a problem there, I don't consider it personal, but Dr. Roney was of the point of view that we really didn't need two Extension Entomologists, and although he liked me as a person, I think, and vice versa, he still wasn't sure that we needed that. That created a little bit of a problem there for a while, but Dr. Roney was getting on toward the end of his career and so it was gradually a thing of my taking over more of the responsibilities as time went along and his backing out and eventually he retired.

Ware: Let me ask you one more question about that relationship. When the crop assignments were changed and you took over cotton which was the major entomological crop in the State, did that change your relationships with Jim Roney?

Moore: Well, I think that any problems there with Jim Roney were already established because of the fact that he just did not believe we needed two people and so I think that he had some misgivings about not being the total Extension Entomologist for the State and have responsibility for all the crops, however I know that he had a strong position in dealing with the cotton problems and certainly when that change was made, it didn't help that situation any at all.

Ware: He had a very close relationship with most of the County Agents and certainly all the growers. Let's talk a little bit about the people that sold chemicals. How many pesticide or insecticide or fertilizer salesmen were there out there in the heydays of 1962?

Moore: I really don't know the number but I do know that the agricultural chemical industry was very, very strong. It became very strong during the 1950's and continued to grow right on through the 1960's. There was a tremendous industry there including a field force that would go out and determine what was going on in the field and would make recommendations to the growers as to what they ought to do in terms of insecticides. Of course, that created some controversy because the people who have an interest in selling materials because they are theirs would be recommending them to the growers and so on. If you look at that situation, I think that is one of the major reasons why we began to think about and to look to developing what we now call the Integrated Pest Management was

to get away from the interests that might not be best in terms of dealing with pest problems and retaining a half-way decent environment to live in.

Ware: Tell me a little bit about a typical company located in one of the cities where there was a lot of cotton being raised. How did they function and what was their relationship to the farmers? Kinda give me a _____ to that.

Moore: You need to break it down into the two different groups as far as the companies were concerned. There are the basic manufacturers and these would be the people like Dow and DuPont and _____ and all of the different ones, _____ and so forth. They're the basic manufacturers and generally those people had what we would think of as marketing oriented people and then they would have development people. The development people were more interested in working with researchers and putting out plots of their own and so forth to develop their materials. The marketing people were responsible for dealing primarily with the distributing companies. Now the distributors were the other group as opposed to the basic manufacturers. The distributors at that time in the early times were companies like AgriChem and Wilbur Ellis and Pure Grow, and a number of other companies of that nature, _____ Company and so on, that are primarily in the business of distributing material - they were the local distributors. Those people were made up primarily of a large staff of people that would deal directly with the farmer and they would maybe have a formulating plant and whatever that they would take care of for keeping the materials ready that they would get from the basic manufacturers. Then this field force would go out, a lot of them would sample fields for the growers and

they would certainly deal very closely with the growers in terms of personal relationships and all this kind of thing - they almost lived with their assigned growers and worked with them very closely. Naturally good relationships developed there and a lot of dependence through the 1950's and 1960's, these people generally had a lot of different materials to select from and they could do a good job for the grower and the grower could just essentially go off and forget his pest problem. They didn't anticipate some of the problems that might occur from that kind of action, what they did was continue to put on more and more materials and everything was going along real well, it looked like that it was just the best of all worlds - the bug problems were not there and the crops were yielding well and all this kind of thing. But then some things started to happen and these were not good things - things like an inability to control some of the pests with the products that they had in the past, and the emergence of pests that were of no consequence earlier became major problems. This sort of thing began to show its ugly head and that's where then things began to become unraveled and we sort of entered the picture in terms of trying to help the growers cope with this kind of a situation that had been created.

Ware: Okay, now I'd like to stop at that point and have you comment on the early 1960's. What were the major insecticides that were being used. Now we know that cotton was the major crop.

Moore: Well, DDT was a major material at that time and a lot of our people used a combination known as Toxaphene DDT. Toxaphene was a material which apparently when added to the DDT helped it to be even more potent than it was by itself. That was a major part of the insecticide applications during the early years there. Actually it started as early as the

mid 1940's, about 1945 or 1946 and it continued to be used right on through the 1950's and into the 1960's with a lot of good results. Now there were some other materials that began to come along and that chlorinated hydrocarbon group included a number of other insecticides like Endrin and Heptichlor and Chlordane and DDT and that general group. Then as those materials began to age a little bit and of course the chemical industry was becoming stronger they discovered another group known as the phosphate, the organio-phosphate materials and those began to come into the picture and somewhat displaced the others, although for a while the two were both used rather heavily. That included materials like Metalparathone and _____ and a number of different phosphate insecticides.

Ware: These insecticides were applied to the crops and I think you need to go into a little bit about irrigation, the timing of applications, aerial applications, what were the formulations used, dust, sprays - sort of a history of that.

Moore: During the time when I first became Extension Entomologist, we were using an awful lot of dust and these were materials that would be put on by aircraft mostly and were put out as a dust. You could see the dust billowing from the airplanes and there tended to be a lot of drift from that and loss of the material from the target area, but as time went along regulation came into the picture and people became more aware of the problems associated with the drifting of dust type materials as compared to sprays and we gradually began to move more and more to spray type applications. I don't remember exactly what

the year was but probably along toward the late 1960's we became almost entirely spray oriented then, and very few dusts have gone on since that time.

Ware: What was the problem with dust?

Moore: Well it was primarily that they would simply drift. You could put out the dust particles and they were such that winds would catch them and drift them away from the target areas and over onto unwanted areas possibly. So I think drift was the major reason for switching from the dust to the sprays.

Ware: I think for the record we need to establish some sort of a number for the number of people that were actually selling and servicing the growers. Do you have an estimate of the peak number about 1962 to 1965?

Moore: I really don't but I'm sure it must have been at least 2,000 or so people, but I would have to go back and look at that, George.

Ware: That would be good. I had the impression that it was somewhere about 400.

Moore: Well, it depends I guess a little bit on what you count as the industries - if you look at the office staffs and everything involved, but if you are looking strictly at field men that are out there sampling and so forth, then it certainly would be less than the figure I was giving.

Ware: I used that number because it seems that that was the number that was a member of the Arizona Ag Chemicals Association. If you had a meeting you'd have somewhere around 400 people attending.

Moore: That is correct and so that is a good way to look at it but I don't really have any way of knowing.

Ware: Nor do I. It's just sort of recall. The problems that occurred from using these organochlorine insecticides such as DDT and Toxaphene, _____ aldrin _____ finally became what - there were two or three of them. Just describe the resulting problem.

Moore: First of all we call it resistance - pest resistance to these materials began to develop. That is that the pests which were controlled by these materials initially, began to develop through a selection process within their own population, those that could withstand these materials and survive and actually do quite well. So I think that pest resistance would be one of the primary ones. Another is that these materials did not break down readily in the environment after they were applied and so there was the problem of residues of these products showing up in not only the crop that they were applied to but possibly in those where these would drift to them, or in those that even were planted into fields where these had been applied in the past and the dust would pick up the material - the wind and dust - and transport it as residues of these products. So I think that the major two would be pest resistance to them and residues from them being deposited on various things where they could not be tolerated. Then the other thing would be in some cases they were associated with secondary type pests being elevated to primary pest status and that would occur because of maybe the destruction of certain beneficial insects within the environment that had previously held down these pests or from possibly other reasons. I think those are the major causes.

Ware: Tell us about the pattern of insecticide use.

Moore: You mean, over time?

Ware: I'm thinking more of the scheduling.

Moore: How they would schedule it? What we had in that day and time was a tendency to become as automatic as possible with your applications. The problem maybe partly was that pesticides were very cheap and growers could withstand the economics of putting on a number of applications and so what we tended to get more and more close to over the years was what a lot of people called the "wash-day schedule." By that I mean like a person maybe washed the clothes every Monday morning, the same would be true with putting on an insecticide. If it was put on this field last Monday, put on another one this Monday and the next Monday and so forth. Just to make sure that you didn't get any problems out there in the field - not necessarily that there any but just to make sure that you didn't get any because they could do this very cheaply and feel secure in not having any insect problems.

Ware: You'd class that then as they thought they were using cheap insurance?

Moore: Yes, that's it.

Ware: The problems that existed were - how can you describe the problems and why they resulted? You've described three problems - resistance, residues in other crops, and the elevation of pests that had not been pests at all to primary status. But what was the real cause of that?

Moore: I think it was the overuse of these materials that affected the natural balance so to speak that was present in the environment or within the fields. We had a situation there where beneficial insects - that is insects that feed on the bad insects were helping to keep the whole insect population within livable numbers, and as we put on more and more of these

materials and affected that balance more and more, these problems were allowed to take place. What happened is that we just got into a treadmill type of situation where one thing required something else and it just got to be an ongoing thing of more and more materials being applied over a longer period of the season and so what that did then was to set us up nicely for elevating a lot of these pests or causing all of these residue problems in crops because the amount of material that was going out just kept increasing and increasing. So somewhere all that had to end, there had to be a cessation of just putting on more and more of these things and in fact those of us that were looking at it said that we can't continue even to do what we are doing now - we have to back off from the use of a lot of these materials then.

end of side 2, tape 1.

Ware: These problems that you described were the result of scheduling and heavy use of insecticides and obviously we got into trouble in Arizona and certainly most of the other States that raised cotton must have had the same difficulty.

Moore: Yes, there's no question about that. What happened is increased concern, sensitivity within the whole society regarding the use of pesticides and people became aware of the fact that there may be more to it than just going out and putting the insecticide on and just walking away that there were other problems there.

Ware: This was about the time that the book "Silent Spring" was written, is that right?

Moore: Right. Rachel Carson came out with her "Silent Spring" and that was sort of the thing that began a sort of a revolution within the industry of insect control or the area of insect

control. What it did was, it created a discussion within the public as to whether these things were really harmful and what might be going on out there and Rachel Carson's book pointed out some of the potential problems. While we haven't seen any silent springs in all of the things that she talked about, the fact is that she had a tremendous impact on what we did and it caused our government people to be more concerned about insecticides and the need to regulate their use. So, over a period of time then, what we saw was the development of a rather large regulatory industry within government, both in the federal level and at the state level. These began to put pressure on the whole gamut of pest control from the universities of people like us that tried to work in an unbiased position to help people down through the chemical industry and to the farmer as to what they could do and couldn't do and all of the different things. There was change occurring and some of us there in the late 1960's saw the need to do some changing and a lot of us had backgrounds in our study and development as young people in colleges that told us that we needed to go back to some more indirect methods of controlling these insects - that we needed to broaden out our scope of control components from just insecticides to a whole gamut of control options that enabled us to avoid having to put on nothing but insecticide after insecticide after insecticide. So we had a group right here at Arizona in the Department of Entomology that came out of training which was related to that kind of thing and that group, the core of it was George Ware as the Department Head, Theo Watson as the Research Entomologist, and myself in the Extension aspect of things. We thought that to really correct this thing we had to do a better job of sampling in the fields to know

what was going on out there, we had to do a better job of prescribing actions and we needed to develop a number of control options that would give us a broad base of control and would not get into an overuse of pesticides.

Ware: That brings us to a significant event, I think it starts in Safford, and I would like for you to begin with that story of the pink bollworm problem in Safford in Graham County, Arizona, okay?

Moore: In the mid to late 1960's, growers over in Graham County were moving, as we discussed earlier, to an automatic controlled schedule for handling the pink bollworm problem that was bothering them in their cotton. They had developed an almost automatic weekly schedule of putting on so many materials over a period of time during the summer to control their pests. The problem is that they began to notice, well they noticed two things - one was that the costs were considerable and secondly that they were developing secondary-type problems. They were destroying their honey bee industry and they were seeing secondary pests that had not been a problem to them before becoming more of a problem. They asked us then if we could suggest some sort of a solution to the problems that they were encountering.

Ware: As I recall, they actually approached Dean Harold Myers who was the Dean of the College of Agriculture. What year was that?

Moore: That was in 1968. They said, "Dean Myers, we've really got problems over here in Graham County and we need some help on it." At the same time, they had contacted me and those of us in the Department of Entomology asking us for our help in dealing with the problem. All of this came together then with our going there and discussing with them what

some alternatives were to the automatic program that they were following. We suggested that they establish a good sampling program and that they treat only when the samples that were taken in a given field showed that that field would need to be treated. These growers adopted that and that program then, they appointed a committee of people to represent them and we worked with them on a continuing basis through the 1969 season and that program was the beginning of what evolved into what, over the next couple of years, was called Integrated Pest Management, or IPM. At that time we called it Insect Pest Management. Essentially what it was to start with was good sampling and use of economic treatment levels, that is a level of a bug based on your sampling that we felt would cause damage if it wasn't taken care of. Unless we reached that level, we didn't do anything. What happened then is, where they had been treating all of the fields every week on a continuing basis prior to the program, they found that some of the fields didn't need to be treated at all and some fields needed to be treated only a few times, yet others maybe needed to be treated about what they had been in the past. Overall, they saw a tremendous reduction in their cost and they also saw a reversion back away from developing these secondary pest problems that had been coming on and causing them trouble in addition to the pink bollworm. That then served as a good example of what could be done to go a different route than the use of insecticides. The important thing was that at about that time, some of our people from Washington were looking for ways of helping this situation on a national basis and they were here in Arizona and they became familiar with the Graham County program. I remember specifically, Dr. Ned Bailey was

here looking at problems that the Department of Agriculture and Science and Education people were being informed occurring with the honey bee industry. He looked into that situation and what all happened was that he asked Dean Myers if Arizona would be interested in accepting a Federal grant to help us establish this same type of program in another area of Arizona where maybe the pest problems were even more severe and we could use that then as a pilot type effort to see if it would be suitable for moving across the country and across the cotton belt. Dean Myers discussed that with Dr. Ware and Dr. Watson and myself and others, and we decided that we would like to do that kind of thing and that, where then the Pinal County pest management program came into being. We discussed it with everyone that we could think of in terms of the agricultural leadership up in that area and we got a commitment from them to establish an insect management program where we would subsidize to some degree the program at its very initiation, but that they would gradually take it over and operate the program on their own assuming that it would prove to be beneficial to them. We started that in 1971 following the successes of the program from 1969 to 1971 in Graham County. That became known as Growers' Pest Management Program in Pinal County. The program that was initiated with the intent of their taking it over worked exactly that way and after three years of partial subsidization of the program, the growers took over all of the funding aspects of it themselves and incorporated it into a non-profit corporation known as Growers' Pest Management. That program is still in operation today.

Ware: I'd like to back up and just comment on the Graham County Safford pink bollworm picture. For the record, it should be noted that this was truly the original insect pest management program in the United States and it began in 1969 when the growers asked for help and the answer was to back away from routine insecticide application. You, Leon Moore, were the pioneer in that and I think this should be recognized in this document. The second thing that should be recognized was that when Ned Bailey came to Arizona, he spotted the significance of this change in pest control techniques and he recognized that as a real change, one that would benefit the growers in the end thus the grant. I think the final thing that became so significant out of all of this was the development of the Growers' Pest Management, Inc. Those growers actually formed together to develop the first incorporated pest management program in the United States. I think it would be good if you could go over the names of some of those people that served in that original corporation.

Moore: I recall some of them. There was Wilbur Wuertz, Howard Wuertz, Joe Cooper, Park Gilbert, Buster Brown, and I believe Raymond Keogh was a member. I'd hate to leave anybody out - Ron Miller was another one.

Ware: Was there one with an Italian name?

Moore: Barcello came on later but he certainly has been one of the important directors of the group since. I was trying to remember the initial group and that was such an important group because a lot of interesting things happened there. There were people, and we should admit, that did not think this was good and I guess I'd have to say especially people within the agricultural chemical industry. Some of them were very displeased that we were promoting this kind of thing and their intention was that it was already being taken care of

nicely by private industry and there was no need to have these government type programs paid for by the taxpayers out here interfering with their business.

Ware: What was the attitude of the Arizona Cotton Growers Association?

Moore: The Association itself now is different from the growers. The Association was not overwhelmingly supportive. I'd think that you'd have to say that they sort of took a "hands off" position and more often than not we were likely to hear bad comments out of there.

Ware: They were not supportive at all if the facts were revealed.

Moore: No, they were not really helpful to us, but the reason I brought this up was that the original group of growers that we were working with were very strong and initially we invited an agricultural chemical company representative to participate on that board.

Ware: Who was that?

Moore: You know, I can't remember right now, George. I'd have to go back and look at the names - I'm sorry I can't remember the person that was involved.

Ware: We can insert it later.

Moore: Anyhow, these growers would meet in their regular meetings and what they discovered after a while was that this person was in a position where he simply tried to put a negative approach to everything. In other words, nothing seemed to be good enough and there was always the attitude "that we really don't need to do this whole thing anyhow." So the growers became incensed by that and I think that gave them a lot more backbone to make sure that they did go ahead and make this thing work. We went through some very tumultuous and rough times there for a while. Not that we wanted to be on the opposite

side of the fence with anybody but we knew that something had to be done to correct these problems that we've already discussed in terms of pesticide use and their effects on the environment. We continued that despite the strong efforts of some to have us derailed and to stop the programs and even to have us fired if they could get that accomplished.

Ware: Let's get into that a little while because I was a

Moore: You were part of it?

Ware: I was one of the recipients of that ire and it came from the ag-chemical industry. Do you remember exactly how that evolved?

Moore: Yes, I remember it quite well. It started off with the fact that they didn't want us into this for the reasons that I gave earlier and so they began to approach from two ways the attempt to get it stopped. One was through political pressures and the other was through objections to the administrators of the University of Arizona. I will never forget the tremendous support that we got from Dr. Harold Myers who was at that time Dean and Dr. George Hull who was Director of Extension. Those two in particular supported us real well in terms of allowing us to go ahead and proceed with these programs and to give us the protection and shielding that we needed to be able to do that. But then these people went to the President and the Board of Regents seeking relief from these programs and the President at that time was Dr. Richard Harvill and he had the whole program investigated himself and I will never forget, I've got a copy of a letter that he wrote to the Arizona Agricultural Chemicals Association. He wrote a very short letter saying that "I have fully investigated the efforts of our people to establish these programs and I find that what they

are doing is totally appropriate to the mission of the University of Arizona." I believe those are almost his exact words and then he signed his name. You can't believe how much we appreciated having that kind of support from the President and that sort of backed those people off a little bit then and gave us some room to operate and to move ahead for a while.

Ware: There's a side story that you may want to reveal in which you Leon Moore, Theo Watson and George Ware were all under the gun. You remember the rest of the story?

Moore: Yes - some of it I may have suppressed in my mind because you don't like to remember those kind of things. I do know this that at one time we were in a position where we thought we would have to resign our positions and that we had actually prepared our letters of resignation, the three of us, and were ready to - and had actually made some contacts to try to seek employment elsewhere, but then things began to occur such as this letter from the President to the Ag Chemicals Association and a few other things that sort of gave us new life and that never came to pass, thank goodness. I do remember that we were all under tremendous pressure for a while there but we felt strongly enough about what we were doing, we felt that it was right and it had to be done and I think that time has shown, more than anything else, that we were absolutely correct. We would have been remiss had we not proceeded to develop this type of a program and it showed that it was of value when the rest of the country immediately picked up on it beginning in 1972 and it became stronger and stronger over the years.

Ware: As I remember, this Ned Bailey visit triggered the introduction of short-term money to start the program in Pinal County. It was repeated the second year and I think the third year. By that time the federal government, the U S Department of Agriculture picked up on this as being significant. Can you go ahead with the national picture?

Moore: Actually, they picked up on it even sooner after just one year of the pilot program here. They began to ask whether or not this was not something which should be looked at on a national basis and we said that it should. I remember that in the winter of 1971 after our first full year of the program in Pinal County that I was asked to attend a meeting and give the results of our efforts in Dallas, Texas, which was attended by representatives from all of the cotton growing states in the country. There were people from Washington there and that was sort of the kickoff from the pilot effort to a more expanded national effort so they at that time began to discuss funding and they broke it down on a State to State basis and began to help people to establish the necessary programs within the Extension Services at the Universities and to get the whole thing going on a national basis. Not only that, but then in the following year they began to look at it from the standpoint of moving into additional crops than cotton. So over a period of about three years it developed from just a little starting point here in Arizona to all of the cotton states and to a smattering of programs in the cereal and forage crops like alfalfa and corn and then into the fruit crops in Michigan and it just began to spread from that and became a national effort in all crops over a period of three or four years.

Ware: The initial program was Insect Pest Management and later it became identified as Integrated Pest Management. Expand on that.

Moore: We started off naturally since we were Entomologists and we were trying to deal with these severe bug and pest problems as simply as an Insect Management Program so it was "IPM" but it was Insect Pest Management. What happened then is that all of us knew that there were additional pests in the crops than bugs. There were, for example, diseases and there were weeds and various other things that could affect the production of the crop that could be called pests and the grower has to deal with these. He doesn't just go out and look at it from the standpoint of one pest as we might do as Entomologists or as a Weed person might do as a Weed scientist. We began then to look at it from the standpoint that should this not be a totally integrated pest management program that would take into account all of the pests that are associated with the production of a given crop like cotton. That's where, then, the word Integrated Pest Management came into being and that was probably within about four or five years of the initial pilot program we had here that that began to develop. From that point on the programs began to be funded as integrated programs and brought in all of the different pest components into the total picture. Since then, there has been a strong effort to make the programs integrated all over although you have to admit that much of the emphasis has continued to be in the area of insects because that's where so much of the problem is. There has been a real effort to include all of the others as well.

Ware: I was going to ask how successful the integration has been?

Moore: I think it's been as successful as the actual situations require it to be, essentially that's usually the way things work out. That is, the amount of trouble that's occurring out there at the grower level is how much attention something's going to have. So the percentage of his concern that would be with for example controlling diseases as opposed to controlling insects is relatively small and his problems in controlling weeds, even though they are a significant problem, they are totally different than controlling insects because the weeds are more of a permanent fixture where they come up where they are and they can be handled, whereas bugs are a dynamic force that you never know exactly what the situation is and there is more of a mysterious nature around controlling the bugs to take care of. So in actuality then, the programs have continued to evolve based on what the problems are out in the field and I think that they've retained that to this day and they will probably continue to do so although that doesn't take anything away from the importance of controlling any aspect of the pest problem.

Ware: We sort of left off after the incorporation of the Growers Pest Management group in Pinal County. That was the beginning of a Statewide effort. Can you go into the evolution of the Extension Service program at Arizona and what happened to additional people?

Moore: We started off in that particular program and we were continuing to work with the people in Graham County but we needed to take the program on to other parts of the State and actually to make it a Statewide effort. We established what is essentially an IPM program within our Department of Entomology and our Extension Service groups and over time, with the funding that we were able to get from various sources on IPM because people

began to see the importance of it and they began to make monies available for expansion and so forth, we were able to obtain enough funding to hire three IPM Specialists to provide assistance out in the State and so we established one position in Pinal County, another in Maricopa County and a third one in Yuma County. Several years later we were able to get another position which is a little bit different, basically the same thing and at Parker in LaPaz County. What happened then is that this gives us all these additional people to help work with the programs out in the State and it has enabled us to proceed with the development of IPM. What it has enabled us to do more than anything else is to bring on the development of community action groups around the State.

Ware: You were saying that there are now four Insect or Integrated Pest Management positions in the major counties. Tell us more about the evolution in Arizona of IPM, what is the program?

Moore: It might be good to discuss how we have evolved as a program and certain events have helped us maybe to focus on development and to make some gains at times. One, for example, would be when the boll weevil became a severe problem in the State a few years ago and it opened up the need to work with growers on a community basis in order to stop that insect from becoming a severe economic problem. The IPM Specialist in Yuma County at that time was Paul _____ and I simply gave him the responsibility to develop a good community action approach to dealing with that boll weevil down there. He did that, did an excellent job, and prepared the county for eventual total eradication of the pest by the USDA and State people who came in later and put the finishing touches on the boll weevil, but that was a good example of the beginning of what

we called community action. We proceeded from that to develop programs all over the State through these IPM Specialists that enabled growers to band together and to work toward attacking weaknesses in the biology and ecology of the life history, so to speak, of the major pests that they had to deal with in their area. That's really the way we need to accomplish things. I'd like to, maybe if I could, use an example of the program we have now in the Marana area. In 1990 we had a severe problem with the pink bollworm as we did across the State of Arizona and it really devastated the growers from the standpoint of yield. Another thing that it did was it caused the necessity for a lot of insecticide applications to control that insect and this got groups that we call environmentalist groups, up in arms and they were threatening and complaining to the growers and then to the State regulatory people about the use of insecticides and it was making it very difficult. There was a bad situation between the agricultural community and the regular people who lived within the community of Marana and surrounding areas. This created a situation where the growers realized that they couldn't continue that way and they then were very prepared and ready for the development of a program out there that would help them to escape that bad circumstance that they were in. We began in 1991 with an IPM program there that included all of the basic things that we've talked about such as sampling and the use of economic levels and a good knowledge of the biology of the pests that they had to deal with and we centered the program around doing something about the pink bollworm and trying to get this environmental problem under control so that people could live together in harmony within the area. What we did then is to establish about a seven or eight point

program to deal with this and some of it involved the use of insecticides that were designed to not have to use insecticides later on in the season and that was based on our knowledge of the biology of the pink bollworm and we found two weaknesses in this insect. One, early season when they are coming out of hibernation, they have to lay their eggs over a short period of time, say about ten days after emergence or they die. If they don't have any cotton fruit out there, that is the squares of cotton when they emerge, then they will die without contributing to the next generation and we call that suicidal emergence. So that's a weakness there - if we could avoid having fruit available to them until most of them have emerged, then we could cut down on the problem tremendously. The other one is down at the other end of the season where they begin to go into a state of diapause that enables them to overwinter, if we can complete the cotton crop and get it out of the field before they are ready for this diapause, then that also causes the populations to decline for the subsequent crop. Those were the two weaknesses on each end of the season and we set up a situation where we used trap crops to bring the pink bollworms when they come out in the spring to real small areas within the community and we would control them there with an insecticide sprayed every three days. Now these were one-acre plots and so it wouldn't take very many of these to cover the whole area. We were putting out a little bit of insecticide in these small areas to kill off these pink bollworms before they could infest the regular crop which was planted a little bit later than the trap crops. That was then an example of using some insecticides so as not to have to use some later. Then we followed that through with treatments of certain of the regular field crops at the pin-head square

period to make sure that we didn't have any susceptible cotton in the fields until about 95% of all the pink bollworms had emerged and died, and that left us a very small percentage then to infest the crops. What that resulted in then was extremely low populations of the pink bollworm to infest the crop and usually we just - now we get by without having to treat any or very little for the pink bollworm at all in the crops after that kind of an opening in the season. Then we simply sample the crop during the regular part of the season and treat as is necessary and try to get the crop to the point of termination and out of the field before the pink bollworms are ready for diapause in the fall. As you can see, there's a plow-down involved and other things there at the end so that's about a seven or eight point program that we're using and what it has resulted in is that the applications have probably been cut more than 50% and we have good data to show the exact percentages but the problem is that we don't have the good data to show what the actual number of applications was before the program began. We do know that it was somewhere in the range of probably seven to ten applications before the program started and now they get by with anywhere from two to four or five applications so that's a tremendous reduction. The interesting thing about it is that we have actually brought townspeople into the process and they've become involved in the program and they feel that it's something that they're a part of as well as the farmers and the complaints and the problems that were associated between the agricultural groups and the others previous to the program have just almost totally disappeared and we don't have that at all. So that's an example in my opinion of a good community action group that is established out there and it's a combination of the

IPM Specialist, the County Agent, and the Extension Entomologist and others working together to make sure that we're using the most up-to-date technology that we have with the knowledge of the pest's biology and ecology. The one thing I should mention that we're using in that program that's certainly new and rewarding is the use of heat units to determine when we take certain action. We know from studies exactly how many heat units are required to take a crop from planting date to susceptible square to the pink bollworm, for example, and that gives us then information that will allow us to set a planting date that would take us past most of the pink bollworm emergence before we have fruit out there that they can reproduce in. This has certainly added precision to all of the actions that we do including the planting date, when we treat the pinhead square treatment and all the other things. It's just another example of how we're using modern technology within these programs and the good thing about the IPM approach is that you have an organization, they have a group there that they call a Task Force of the growers that the IPM people work with and these people are appointed by their fellow growers to represent them and they meet regularly and if anything new comes along that can be plugged into the programs, it can be plugged in easily and quickly and if some changes need to be made because of circumstances that occur during a given year, they can make those kinds of changes. One of the nice things about the IPM community approach is that it does allow the flexibility that we need to deal with the problems as they occur and to make improvements from year to year as we move along in the program. I don't consider

IPM as the type of thing that's closed in, that we've ever reached the ultimate, it's always open and there'll be new additions to it as we go along as new things are found that work.

Ware: You would consider IPM a dynamic pest control technique?

Moore: That's right, that's exactly right.

Ware: Well you've been a professional Entomologist for how many years?

Moore: I guess you'd say since 1959, so that's about 35 years at this point.

Ware: You've seen a lot of changes over those 35 years, most notably in retrospect how do you see the insect pest control picture changing across the nation, but particularly in Arizona?

Moore: During that time of course the big change was that we went from almost unilateral use of pesticides to control problems to a gradual backing off from those because of the problems that we encountered. The other thing that I've noticed throughout my career is that the bug problems have not become less, they've become more and it seems like there's just a gradual stair-stepping of problems associated with agriculture that have to be dealt with in terms of bugs. I think those are the things that occur to me most. But I'm most proud, though, of the fact that all of agriculture has now espoused the integrated management approach in which they are trying to utilize all of the alternatives to pesticides in the best ways that they can, but to retain pesticides as one element of use when they need to be used. I think that they generally are recognized as still a very important tool and probably will be used for years to come. I also want to say at this point that one of our biggest supporting groups now is the chemical industry that we had to absolutely fight almost at the beginning of the IPM effort. Especially the basic manufacturing groups and others have

realized the important of this approach and instead of being adversaries now they're among our best supporters in terms of the development of IPM. Many of the chemical industry people from the basic manufacturers on down are looking at the alternative, the softer type insecticides that they can get into and the new types of chemistry that are not harmful within the environment and all of the different things that they can do to participate in the movement that's obviously taking place in terms of developing the Integrated Pest Management approach.

Ware: What do you see as the future for insect control, 20 years, 10 years, 50 years down the road?

Moore: That's difficult. I don't suspect that we're going to be able to produce the food and fiber that we need in this world without having some pest problems. I think we're going to continue to do that because as we attempt to produce higher yielding crops and all of the other things, we also at times open ourselves up to pests. I think that we will see continued development of these alternatives and to the less harsh type of chemicals that have been used in the past and I believe that that will be something that we can all be proud of and that they can be used in such a way that they won't be harmful to us as a society. I do think that regulation will be a continued problem for the growers and I think it's something that they're beginning to recognize nowadays and they'll have a lot more ease in dealing with that as time goes along. It's hard to visualize what's going to happen 'way on down the road, but I don't see any end to the pest problems and having to deal with them in one way or another as long as we're having to feed so many people and that's certainly going to increase rather than decrease over time.

Ware: What do you think the role will be for the biological materials that we consider for controlling pests in an indirect way, the indirect control measures - the pheromones, the ecdysones, the growth regulators - these are classed as biorations. Leon, what role do you see being played by the biorational materials that we currently have. You might describe a few of them.

Moore: We're going to see additional effort from the basic manufacturers on down and as they come up with better materials and with the additional effort that we're seeing now at the research level within the universities and the USDA and everywhere else, we're going to see a lot more use of the biorational type materials. A good example would maybe be in the areas of the BT's, that's bacillus _____ which is a bacteria that is effective in controlling insects. We're seeing that approach now from a standpoint of actually putting it into the cotton plant, for example in such a way that when the insect feeds on that cotton plant it provides a form of resistance by killing the pests as they feed and never allowing them to get started. New and better formulations of it are being developed for overhead application and the good thing about the BT is as far as ever been able to determine, it's totally harmless to people and other animals. So there's a good wide open area for this type of material and I think we'll see additional types of materials come along that fit into that same type of category as more and more emphasis is being put on it by the companies and other people and by the governmental research agencies such as the USDA. These kinds of things are going to come on. We know the pheromones have a lot of potential - we've just scratched the surface probably the way we'll use the pheromones in the area of monitoring and the area of mating disruption and confusion and

so I look for those kinds of things to play a greater role. I think the big thing is, along with the beneficial parasites and predators which I think will play a much more major role in the future that these things can be brought together with the attention that we're giving to applying them now in such a way that they'll take a lot of the need for pesticides away and then we won't have to call upon them so often in the first place. I think biorational control will just become almost second nature to us in the future. You and I had trouble remembering it here a little bit ago, but maybe in the future I think it's going to become the number one way of handling our pest problems.

Ware: I want to start bringing this interview to a close and I'd like to ask you to think back over your career and see if you can recall who played the greatest role in your life or who had the greatest influence on your life professionally?

Moore: To go back and remaining in the professional area away from parents and that sort of thing and my own family, I would say that one person really stands out, George, and his name is Dr. Charles Lincoln at the University of Arkansas. Dr. Lincoln was in my way of thinking an eminent, just tremendous economic entomologist in the field of cotton and I think he had insights in his time that were far, far ahead of the ball game that we were playing and the things that he was trying to teach us when we were going through there, did teach us, certainly came to be and I think that his ideas were so important in establishing the base that we could build integrated pest management from that has become so important. I know that he took a lot of his ideas and training from a lot of people that he was surrounded by like Mr. Dwight Isely. He was also a person, I think, with a lot of

insight that contributed to that atmosphere there at the University of Arkansas which several of us got our start and our general philosophy and everything else from and has stuck with us through the years, and then to be able to be fortunate enough to come together by chance largely with two other people, George Ware and Theo Watson, out of the same mold who had many of the same interests and much the same training and the philosophies were similar, I think that probably enabled us to contribute to this IPM development in a way that we never could have done otherwise. I feel very fortunate that those kinds of things happened. I would never want to forget the administrators that helped us in particular, Dean Myers, George Hull and even President Harvill, and I'm sure there were others there. The County Agents within the State of Arizona have really been good and solid and they've stuck with the need to develop the Integrated Pest Management programs and have done a good educational job there despite the pressures that were on them to go in other directions at times. I think if I were looking at people, that's sort of a rundown of the way things were and the ones that have meant so much to me. I could never ever have accomplished the things that I was able to accomplish without those people and I look at anything I've done as a team effort in which I was just one of that team.

Ware: I have one closing question. Leon Moore, how would you like to be remembered?

Moore: I guess I would like to be remembered as a person who worked hard to improve the ability of people to deal with insect problems and that maybe I have, in some way,

contributed to an approach to insect control that has been beneficial not only to agriculture but to society in general.

Ware: It would be hard to get all that on a tombstone, but I would like to see you remembered that way as well. Leon, this has been a very fruitful interview. I've enjoyed talking to you and placing on tape your recollection of your career and how you brought about insect pest management into integrated pest management on a national picture. The day once again is April the 15th, 1994, and Leon, I want to thank you for your participation.

Moore: You're more than welcome and I appreciate the opportunity.

Ware: To future generations who may read this, know that Leon Moore left his mark on insect control in the 20th century.