

## **Second green revolution through precision agriculture**

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Bhau Kadam (name changed) is a small sugarcane farmer in Western Maharashtra. He and his family own about 3 ha of land. Kadam has two sons who are both graduates and work in Pune. When I asked him why he did not make his sons farmers he says that farming is hard work, is non remunerative and it is difficult to get labor. Besides he also thinks that farming is not glamorous, farmer's son is a non- marriageable commodity and that his sons have a better life in Pune!

Kadam is getting on with age and is thinking of selling his land to the highest bidder and moving out of farming and may even go and stay with his sons in Pune.

Village after village and state after state this is the story of most farmers in India. They want to sell their land and move out of farming. Indian Agriculture is in crisis. No matter how advanced or rich we become, all of us have to eat food. We cannot eat software or nuts and bolts!

I feel wealth and security of the country comes from its land and hence what is needed is sustainable, high tech and high productivity agriculture which will be remunerative and help provide both food and energy security for the country.

Precision Agriculture which can provide precise inputs like water, fertilizer, insecticides at the right time to crops can provide this and will help bring in the next green revolution to Indian agriculture.

### **Existing agricultural scenario of India**

India is characterized by small farms. Around 80% of total land holdings in the country are less than 2 ha (5 acres). Mostly it is rainfed with only 30% of the land irrigated. Around 55% of total population of India depends on farming. In U.S. and other advanced economies, because of heavy mechanization of agriculture, it is less than 4%.

Because of poor availability of funds, farm inputs, poor support price structure for the produce and almost no farm insurance, most of the farming is non-remunerative and 50% of the farmers in India are in debt. This is the main reason for a large number of suicides by farmers.

Also without mechanization farming is hard, back-breaking work and not glamorous. This has resulted in most farmers' children quitting farming and going for other vocations. Also farmers get more money in selling their land to builders, malls and factories than they would ever get from farming. This has put more pressure on farm land thereby requiring technologies to increase the productivity so that shrinking farm land can feed billion plus people of India in the future.

India, though one of the biggest producers of agricultural products, has very low farm productivity. Average productivity of Indian farms is 33% that of the best farms world over. This productivity needs to be increased so that farmers can get more remuneration from the same piece of land with less labor. Precision agriculture may provide a way to do it.

### **Precision Agriculture (PA)**

Precision agriculture, as the name implies, means application of precise and correct amount of inputs like water, fertilizer, pesticides etc. at the correct time to the crop for increasing its productivity and maximizing its yields.

PA has originated in U.S. and European countries.

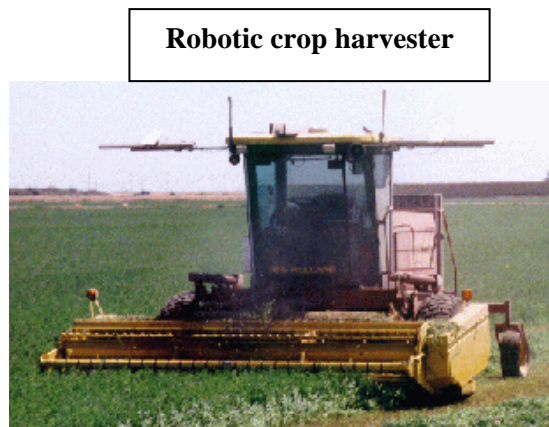
Since the farms in these countries are generally big (> 100 ha) hence the use of Global Positioning Satellite (GPS) is extensively used in PA. GPS allows precise mapping of the farms and together with appropriate software informs the farmer about status of his crop and which part of the farm requires inputs like water, fertilizer and pesticide etc.

Precision agriculture in western countries is also characterized by increased mechanization with the use of heavy farm machinery (average power of the machinery is 100-200 kW) for all the farm and field operations such as sowing, harvesting, weeding, baling etc. This machinery runs on fossil fuels and uses about 63% of the total energy used in farming. This is a significant amount.



PA for small farms on the other hand can use small farm machinery and robots which may also be amenable to run on renewable fuels like bio oil, compressed biogas and electricity produced on farms by agricultural residues. Besides the energy efficiency of the machinery and operations could also be improved.

For small farms precision agriculture may include sub-surface drip irrigation for precise water and fertilizer application to the crops and robots for no-till sowing, weed removal, harvesting and other farming operations. Some of these robots are already being used on small farms in US and Europe and with vigorous R&D taking place in their development, it is expected that they may be deployed in large scale in near future.



Similarly drones which are unmanned aircrafts and are extensively used in wars have started being used in Japan and U.S. for insecticide application to the crops. Use of drones for agriculture is proverbial “turning swords into plows”!



Most of these robotic machines and drones are small in size and hence are very suitable and excellent match for small farm applications. Thus small farms size of India is a blessing in disguise and ripe for large scale application of precision agriculture.

Precision agriculture (PA) in U.S. and other countries has shown tremendous increase in productivity, lowering of inputs and hence increased remuneration to the farmers. Besides it has helped improve the quality of land with no-till farming and less water usage. Similar things are possible in India with the use of PA.

### **Criticism of mechanized agriculture**

The biggest criticism of mechanized agriculture is that the farm machinery is very costly and no farmer, including big ones, can afford it. Since precision agriculture is going to be very dependent on mechanization hence this criticism is presently justified.

However I feel the mechanization and PA may give rise in a big way to farm machinery leasing agencies in rural areas. These companies or enterprises will lease the mechanized

equipment, including drip irrigation systems, to the farmers and also provide trained manpower to run these machines. Such a thing already exists on limited scale in India where few agencies do the wheat harvesting using combines and spraying of crops. They charge the farmers on per hour basis and with the unavailability of farm labor, farmers find this concept economical and attractive.

In Western Maharashtra more and more farmers are depending on mechanization offered by such agencies. With increasing demand these leasing enterprises will increase and as PA develops and increases they will get more structured so that just like private taxi companies they will be available on demand.

It is also envisaged that these leasing companies may form the backbone of Indian agriculture by providing the necessary advice and manpower to the farmers on precision agriculture.

Critics of mechanization also contend that by timely sowing of crops and applying proper and recommended water and fertilizer to it, a farmer can easily improve the productivity of crops and his income. However application of inputs at proper time requires timely availability of labor, water and fertilizer. These things are becoming scarcer and scarcer. Besides majority of farms are rainfed and with the change of weather pattern, availability of rain water is very unpredictable. Hence the non-availability of inputs and labor on time is the biggest stumbling block to increase productivity of farms and remuneration. Precision Agriculture as discussed above can help in this matter.

To my mind the ultimate role of a farmer should be to identify better crops, use that seed to propagate it further and hence in effect become a breeder of sorts. Progressive farmers already do that and with more time available to them because of PA they may be able to help the India agriculture to produce better and higher yielding varieties. Also the mechanization will make the farming glamorous and may attract more people to take up farming in a big way.

### **The way forward**

The most important component in taking PA forward will be in creating a huge resource of engineers, scientists and agriculturists to develop various components of the technology. Without excellent manpower and consequently good R&D, PA will not succeed. One of the misfortunes of Indian education system is that all the good students want to get into engineering and medical streams and only the left over students go into agriculture. There is

a need for excellent engineers from institutions like IITs, NITs, etc. to design machinery like robots and drones for PA. This can be facilitated by establishing a new branch of engineering called agricultural mechanotrics or robotics where faculty and students from almost all branches of engineering will interact and collaborate to develop smart systems for PA.

Another way forward is when scientists from ICAR institutes, engineers from academic world, industry and farmers work together in developing PA. I think industry has to take charge since they will develop the machinery and set up the leasing agencies. And with jobs creation in PA better students will join agricultural mechanotrics stream.

I also feel that PA may provide a platform for industrial corporate social responsibility (CSR) activity. After all helping the rural poor improve their livelihood through high tech farming should qualify as a CSR activity. The Government of India can facilitate in this process by giving soft loans and sops to the industry so that they get more engaged in agriculture and PA activities.

High tech PA therefore can help in bringing next green revolution to India and can produce tremendous rural wealth in a sustainable and environmentally sound way.

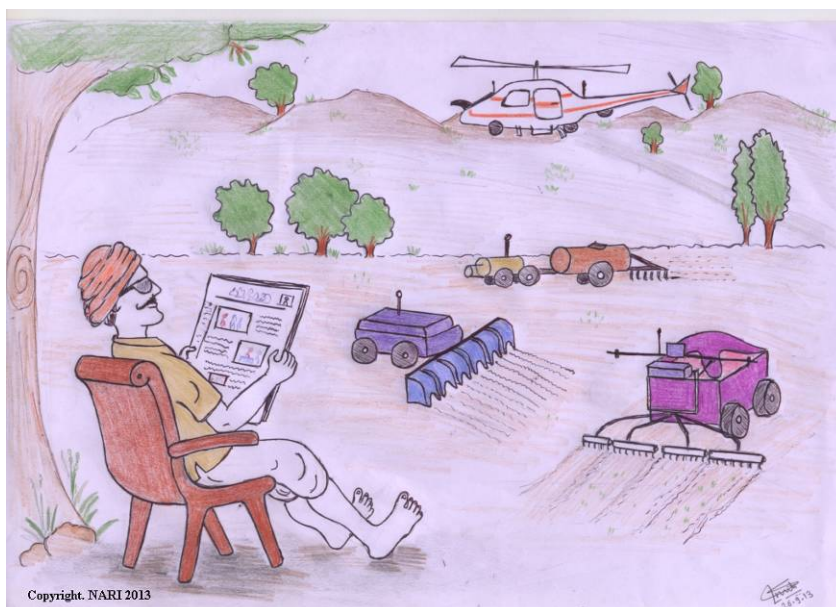
Farmers and farms are the backbone of any country since they can produce food, fuel (agricultural residues) and wealth from the land. They should be helped by all members of society and developing PA is a step in the right direction.

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